MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 39 NOVEMBER, 1932 Number 3

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 240

A High-grade Paint Job Calls for Close Attention to Details—
By Frank W. Curtis 161

How the Pantograph Aids the Diemaker 166

Selecting the Right Cutting Tools in a Modern Machine Shop—
By J. M. Highducheck 172

Editorial Comment 178
Industry's Stake in the Tariff and Debt Situation—The New Problems of a New Era Require New Solutions—Speeds and Feeds Cannot be Easily Standardized

Advances in Grinding Machines to Meet the New Needs of Industry 182

Power Presses Offer New Possibilities in Production Work 189

Some of the Results Achieved by Automatic Polishing Methods 194

Gear-cutting Machines of Recent Design Have Speeded up Production 197

How to Crate Machinery to Prevent Damage in Transit—*By John G. Davies* .. 202

Many Shop Problems Discussed at Buffalo Meeting 209

Power Consumed by Self-opening Die-heads—*By C. W. Bettcher* 210

Machine Tool Builders Discuss Pressing Problems of the Industry 213

Manufacturing Equipment to Meet the Needs of the Designer 214

Suggestions for Inter-industry Planning—*By L. M. Waite* 215

DEPARTMENTS

Special Tools and Devices for Railway Shops 170

Notes and Comment on Engineering Topics 176

Ingenious Mechanical Movements 179

Design of Tools and Fixtures 205

Shop Equipment News 219

Product Index 72-84 Advertisers Index 87-88

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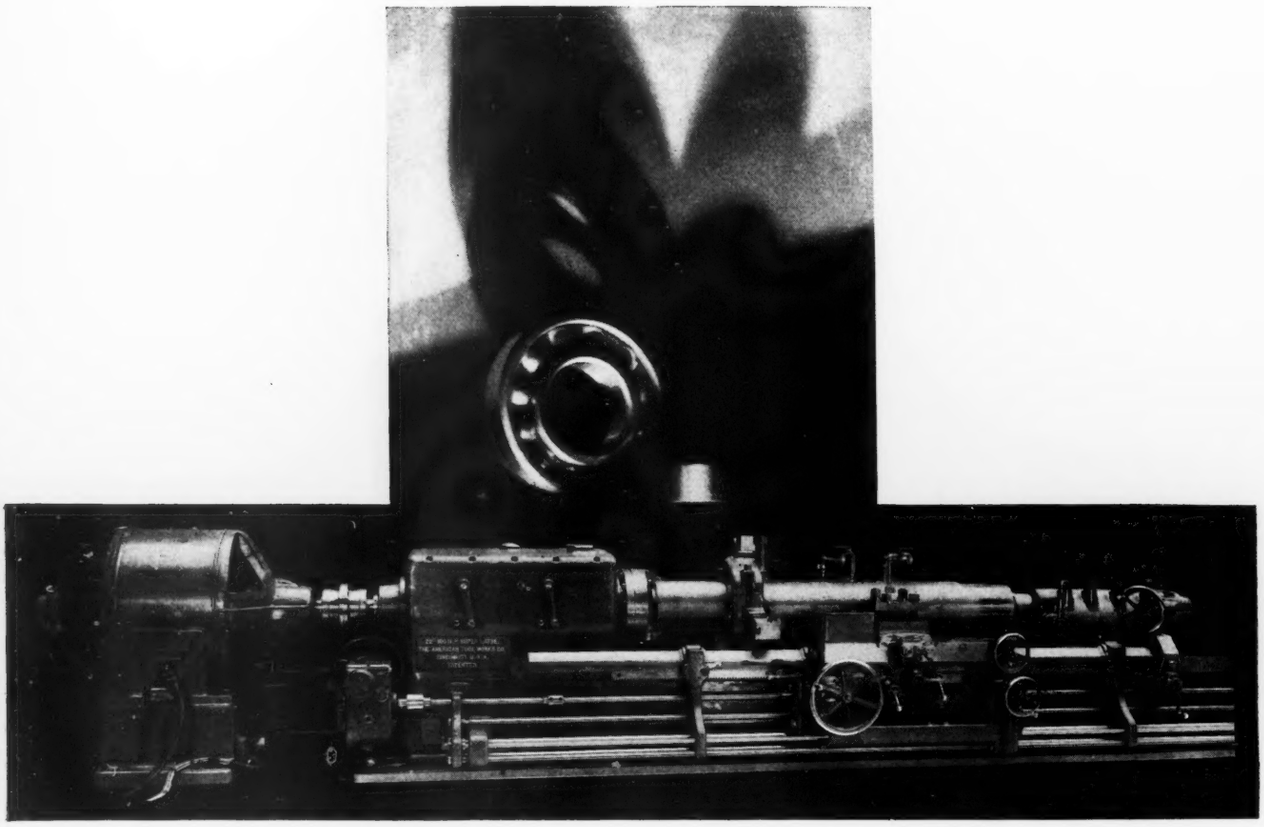


SUPPOSE YOU NEEDED SUCH A LATHE . . .

. . . a giant of twenty tons, with 140 spindle speeds and 100 horsepower input; where would you go to have it built? To some experienced lathe builder, of course. And that builder would go to experienced bearing builders and other craftsmen for specialized help. That is what happened here. The American Tool Works Company was commissioned to build it, and New Departure Ball Bearings were engineered into 57 important positions. Where a large investment is involved, and reputations are at stake, engineers are careful to select materials that will do them credit in the final tests. The regularity with which New Departures are chosen in cases like this is a sincere tribute to their sterling qualities. And their cost over others, if any, is very slight. The New Departure Mfg. Company, Bristol, Conn.; Detroit, Chicago and San Francisco.

• NEW DEPARTURE BALL BEARINGS •

MACHINERY

Volume 39 NEW YORK, NOVEMBER, 1932 Number 3

A High-Grade Paint Job Calls for Close Attention to Details

By FRANK W. CURTIS

Research Engineer
Kearney & Trecker Corporation
Milwaukee, Wis.

MACHINES are seldom bought on performance alone. Today buyers demand not only that the design be such as to meet the requirements of the service for which it is intended, but that the construction be pleasing to the eye and the finish such that the machine will harmonize with its surroundings. It may be said that an appreciation of true beauty in machine building has invaded the shop and factory.

Paint plays a most important part in the matter of machine appearance, because even though the design is artistic in itself, all surfaces not finished by machining must be painted if the product is to be a really fine looking one. And any machine that results from the use of high quality materials and expert workmanship deserves that distinction.

The painted finish of machinery, however, should not only be good looking, but should be so applied that it will stand up under years of hard service without cracking or chipping. It should also resist the action of cutting compounds, oils, greases, acids, and moisture. If the finish is to be lasting, casual attention to the painting job will not do—this job must be considered one of the important steps in the manufacturing process.

At the plant of the Kearney & Trecker Corporation, the painting of all castings begins before any of the machining operations are performed, as will be apparent from Fig. 1. As a preliminary to painting, all large castings are sand-blasted inside and outside before they leave the foundry. Small castings are sand-blasted by means of equipment installed in the machine shop. The sand-blasting operation is an important one, because unless all rust and foundry sand are thoroughly removed, paint will not adhere to the casting surfaces. This is the first of the many details that must be observed if the final paint job is to be really satisfactory.

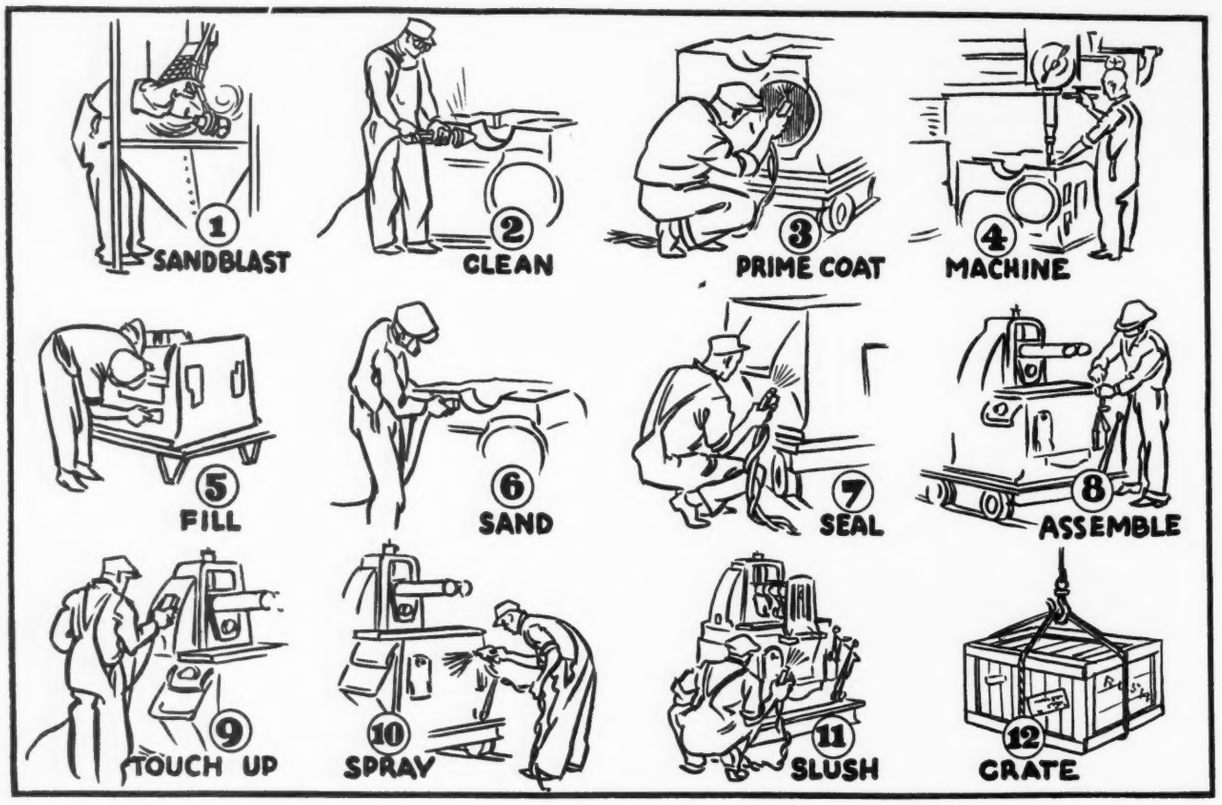


Fig. 1. Pictures that Tell the Story, Step by Step, of How a High-grade Paint Job is Done

After the sand-blasting operation, portable power-driven grinders and chisels are employed, as shown in Figs. 2 and 3, to remove high spots and eliminate roughness from the casting surfaces. The fact must be borne in mind that every high edge or spot not removed from the casting at this stage means more filler later on, if the job is to be well done.

The Primer Coat is Applied Before Any Machining is Done

When the castings have been thoroughly cleaned and smoothed up, the primer coat is applied both inside and outside without delay, so as to expedite the delivery of castings to the machine shop departments. Mimax Red Crankcase Sealer No. ML2762, made by the Pittsburgh Plate Glass Co., is sprayed on the inside surfaces. Denatured alcohol is used with this sealer in the proportion of two parts of sealer to one part of alcohol. A DeVilbiss Type CV spray gun is used for the operation. As this sealer paint requires about four hours for drying, the work is usually allowed to stand over night after the paint has been applied.

All outside surfaces, with the exception of those that are to be machined, are sprayed at this time with Machine Primer Gray No. 16953, made by the Lowe Bros. Co. Three parts of turpentine are mixed with five parts of paint for thinning. A DeVilbiss Type AV spray gun is used for this operation, as well as for all the coats applied later on. This outside primer coat dries within thirty minutes.

By applying the primer coat at this time, rusting during and between the machining operations is guarded against. Oil, grease, or cutting coolant are also prevented from entering the pores of the casting. These are important factors, because rust is difficult to remove and spreads rapidly, while oil or grease that gets into the casting pores will come up through the paint in time and spoil the appearance of the machine. Another advantage in giving the casting its preliminary coat of paint at this stage of the manufacturing process is that the machine operators have clean castings only to handle.

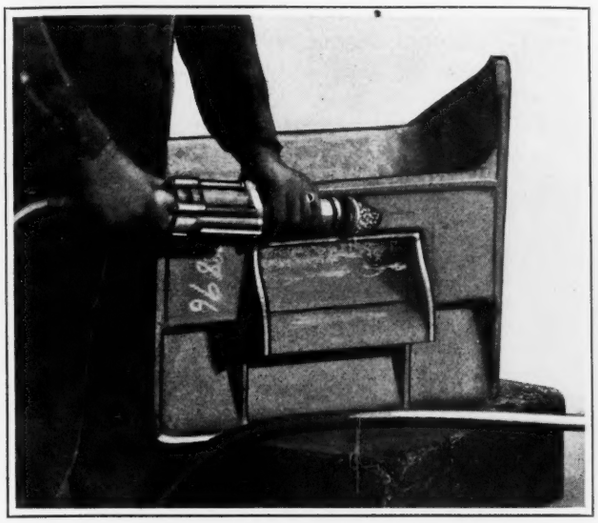


Fig. 2. Cavities and High Spots Must be Eliminated from the Casting Surfaces to Avoid the Necessity of Excessive Filling

Fig. 3. Power-driven Chisels and Grinders Facilitate the Preparation of the Castings for the Primer Coat of Paint

The sealer that is sprayed on the inside surfaces not only prevents those surfaces from rusting during the lifetime of the machine, but gives really good looking individual parts. It also makes certain compartments suitable for use as oil or coolant reservoirs by sealing the particles of sand and dirt in place so that they will not loosen and get into the liquid.

A Real Paint Job Depends on Proper Filling

Complete machining of the castings follows the drying of the primer coat. Now another of the most important steps in the painting process is reached —that of filling so as to eliminate all low spots or high points. Unless the casting surfaces are filled properly, it is impossible to produce flat even surfaces or continuous smooth contours, no matter how many top coats of paint are applied. Satisfactory filling depends to a large extent on the previous primer coat; if the metal surfaces are not well covered by the primer, the filler will not stick.

The filler is first applied to most castings with a knife and then with a brush. The use of a knife enables the painter to press the filler firmly into the casting in the manner illustrated in Fig. 5, while the brush is used for finishing up by applying a lighter coat.

In the case of milling machine columns, the filler is first sprayed on. Then cavities and rough spots are filled in by using a knife, after which a second coat of filling is sprayed on. At the end of fifteen minutes, a third coat is applied with a spray gun. Milling machine knees are handled in a somewhat similar manner, except that after the knife filling, filler is applied with a brush, because of the many corners on these parts.

The filler used is Lowe Bros. Gray Iron No. 17718. It is black in color. Turpentine is used for thinning the filler to a paste for "knifing" and to a

Fig. 4. Red Crankcase Sealer is Sprayed in the Inside of all Castings to Oil-proof the Surfaces, Prevent Rusting and Seal in Particles of Sand or Dirt

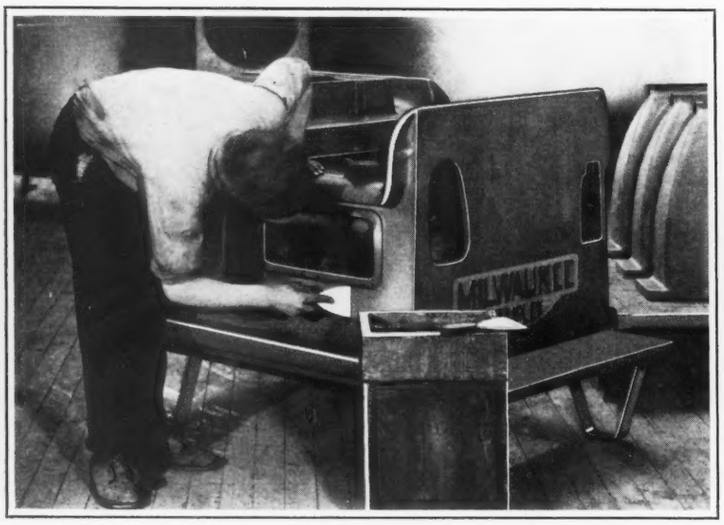


Fig. 5. Filling is One of the Most Important Steps in the Painting Process —Unless This is Properly Done, a Satisfactory Finish Cannot be Obtained

liquid for brushing. For use in the spray gun, five parts of turpentine are added to four parts of filler. After the filler has been applied, the castings are allowed to dry for twelve hours.

The Castings are Sealed to Prevent the Oil from Penetrating the Filler During Assembly

When the filler has dried completely, the castings are sanded all over in order to smooth all surfaces. A small portable Paasche air-driven machine with two pads that reciprocate rapidly is employed for sanding the large flat surfaces, while the corners, contours, and fillets are sanded by hand. Adalox-Durundum Cloth Openkote, Grit OJ80, made by the Behr-Manning Corporation, is used on the power-driven device, while Production Paper No. 2/0 C, made by the Minnesota Mining & Mfg. Co., is used for hand-sanding.

Upon the completion of the sanding, the filler is sealed by spraying on a coat of Lowe Bros. Pyroxylin Sealer Gray Lacquer No. C-4505.

Sherwin-Williams Opex Thinner No. 4882 is mixed with this lacquer in equal proportions. The lacquer dries in thirty minutes. It preserves the filler during the assembly of machines by preventing oil or grease from getting in it. The heading illustration shows a machine that has reached this step in the painting schedule.

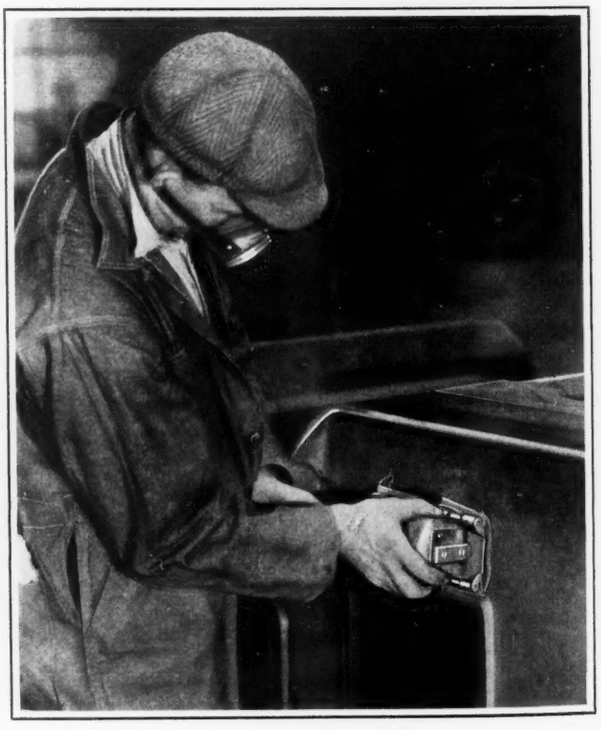
Final Stages of the Painting Process

When the machine has been completely assembled, it is washed all over with high-test gasoline to thoroughly remove dirt, oil, or grease. It is then completely sanded by hand with a finer grade of paper than was used before. (Production Paper No. 4/0 C-MT150, made by the Minnesota Mining & Mfg. Co.) Low spots or marred surfaces are filled in with Lowe Bros. Non-Shrink Pyroxylin Putty C-4785. Fifteen minutes after the putty has been applied, it is sanded and rubbed down. The machine is dusted off well at the end of this "touching up" operation.

All polished or machined surfaces are now covered with vaseline or oil to protect them during the final painting. Certain parts, like the over-arms, are covered with cardboard masks, as seen in the heading illustration. Two finish coats of Lowe Bros. Pyroxylin Sealer Gray Lacquer No. C-4505 are then sprayed on, with an interval of ten minutes between the two coats. Sherwin-Williams Opex Thinner No. 4882 is now used again, but in the proportion of 3 3/4 parts of lacquer to 2 1/2 parts of thinner. A No. 12 nozzle is used in the spray gun for these two coats.

Fifteen minutes after applying the second finish coat, the painting job is completed by spraying on a coat of Lowe Bros. Standard Machine Tool Gray Lacquer No. C-5123.

Fig. 6. All Surfaces to be Painted are Smoothed Down by Machine- or Hand-sanding before the Final Coats of Paint are Applied



The thinner used with the previous two finish coats is employed again, but in equal proportions with the lacquer. A No. 12 nozzle is used in the spray gun for this final coat. Fifteen minutes after the painting has been completed, the machine is ready for removal from the painting booth.

Lacquer not only gives lasting glossy surfaces, but on account of its fast drying properties, it also speeds up the painting operation. Little time need be lost in waiting for the paint to dry. Another advantage of lacquer is that each coat tends to blend in with the previous one. Thus, if the occasion arises when it is necessary to repaint any portion of a casting, the "touching up" cannot be detected.

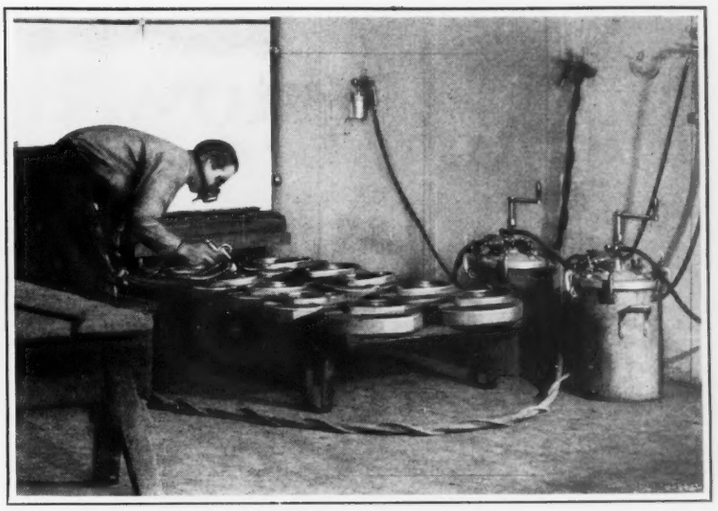


Fig. 7. The Filler is Protected from Oil and Grease during the Assembly of the Machines by a "Sealing" Coat of Lacquer

Slush is Sprayed on the Machined Surfaces

After the finish coat of lacquer has dried, the vaseline, oil, and masks that have protected the machined surfaces are removed, and these surfaces are thoroughly cleaned. Then, Smith's Confining Slush Oil is sprayed on the machine surfaces to protect them from rust while the machine is in storage or in transit to the customer's plant. This gives the surfaces an even covering of light yellow grease and does not spoil the appearance of the machine. The slush is applied in about five minutes.

The various spraying operations that have been described are performed in booths that have white walls and ceilings and are well lighted. Large fans insure the withdrawal of all fumes and a supply of fresh air to the painters. For the final coats of paint, the assembled machines are placed on trucks that run on tracks leading in and out of the booth. This booth is about 20 feet wide, 12 feet deep, and 10 feet high. Two machines can easily be handled at one time.

Perhaps the most important point in the entire painting process is to make sure that the castings are thoroughly cleaned at the very beginning. Unless the foundation for the paint is clean, the job will be an imperfect one. The use of spray guns saves much time and gives a uniform finish.

Stainless Steel is Well Adapted to Spot-Welding

According to V. W. Whitmer, metallurgist of the Republic Steel Corporation, Massillon, Ohio, stainless steels are particularly well adapted to spot-welding due to their clean surface, freedom from oxide or scale, and the absence of any coating, like zinc or lead, such as would be present on galvanized or terne plate stock. Stainless steel, such as "Enduro," will, in general, require less heat for spot-welding than the same gage thickness of ordinary steel, due to its lower heat conductivity (which tends to concentrate the heat in one spot), its lower melting point, and the better contact possible when welding, because of the scale-free surface.

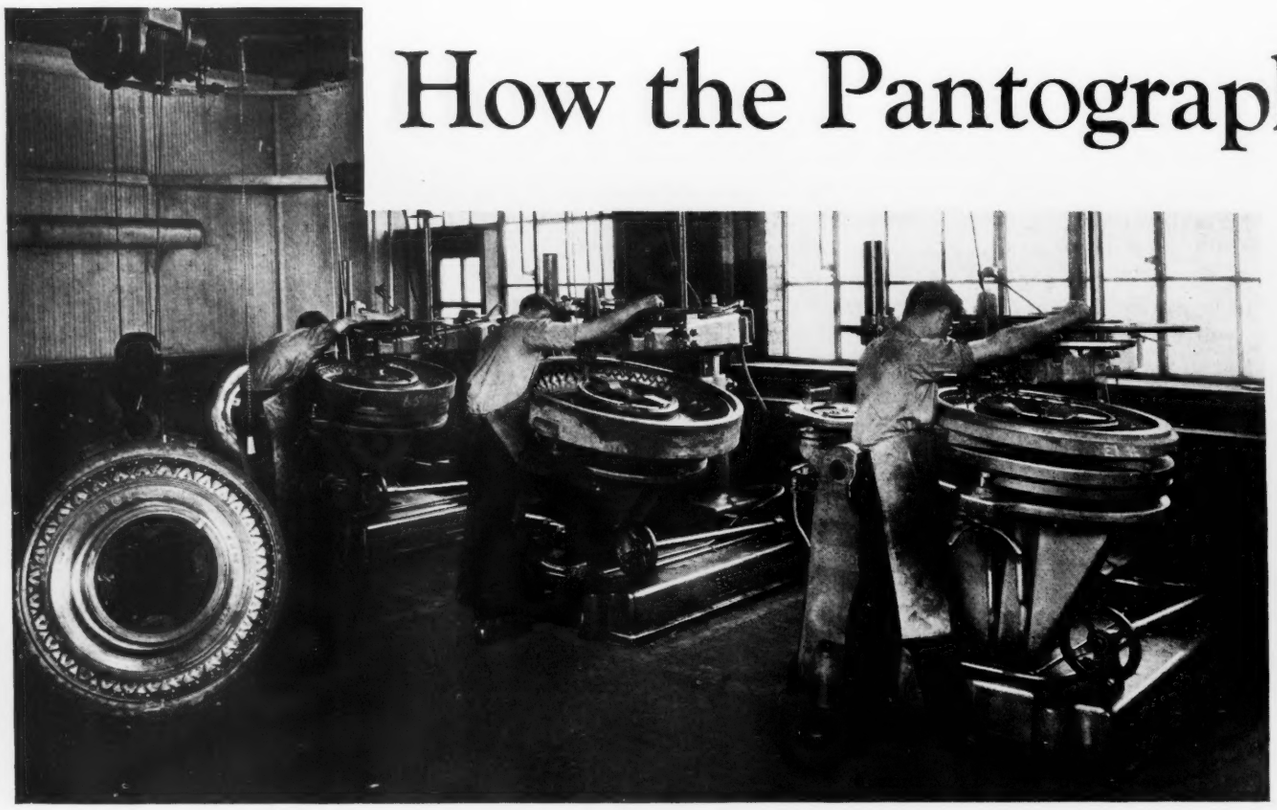
In welding polished stainless steel, it is advisable to place the welds in the least conspicuous locations, as it is often difficult to refinish them to the same color as the rest of the sheet, unless the whole piece is refinished.

Spot-welding, like any other type of welding requiring high temperatures, will form an oxide on the surface which will be blue in color. If this is exposed to the weather or moist conditions, it will slowly change to a brown color resembling rust. This, however, is only a surface condition, affecting the original oxide only. If such welds are to be exposed to the atmosphere, they should either be cleaned with acid, as in pickling, in the case of No. 1 finish sheet, or ground and polished, if No. 4 or higher finishes are employed. In the ground and polished state, spot-welds are just as resistant to a salt spray as the original metal.

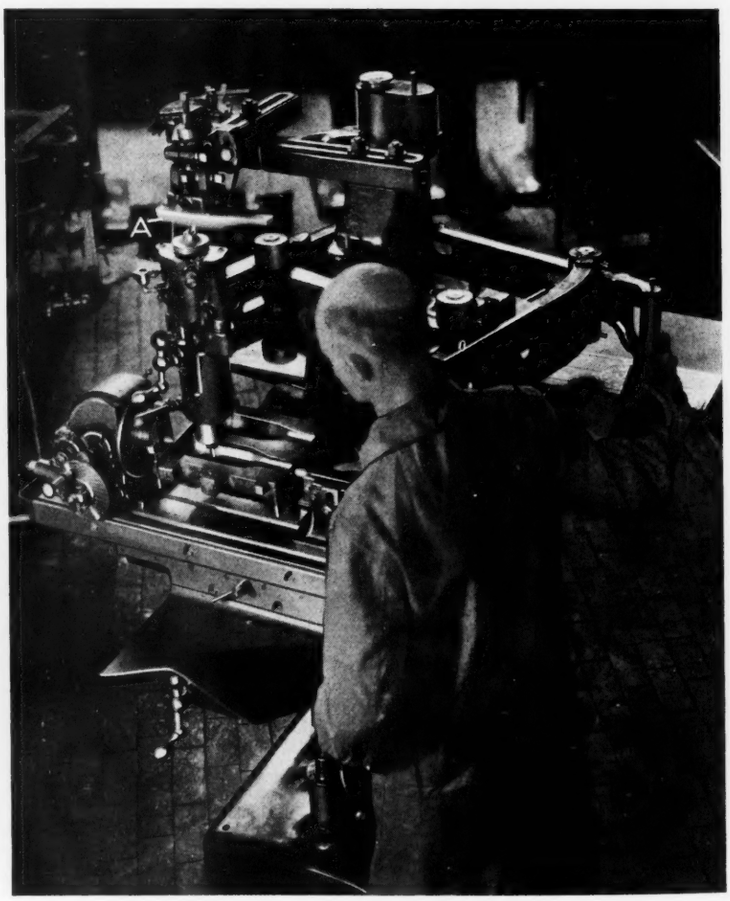
* * *

To obtain sufficient strength in machines, a designer advises: "When you can't add brains, add weight."

How the Pantograph A

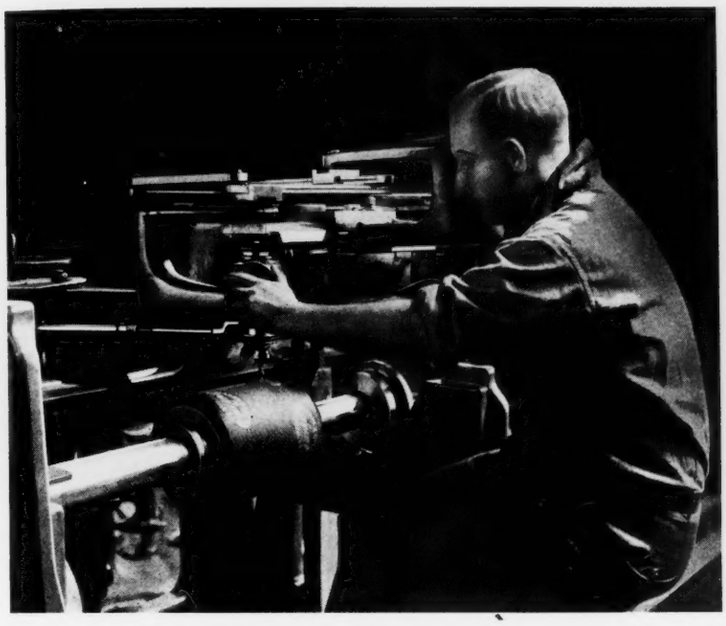


Artistic treads are produced on automobile tires at low cost through the use of pantograph-type die-cutting and engraving machines. With these machines, intricate designs can be readily cut in the molds used for vulcanizing the tires. Flat templets are employed to guide the tools. The machines shown above, as well as all the others illustrated, were built by the George Gorton Machine Co., Racine, Wis.

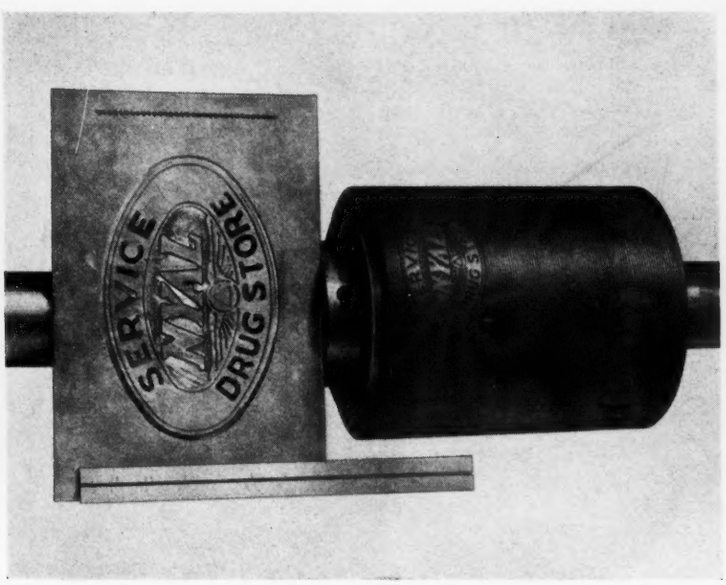


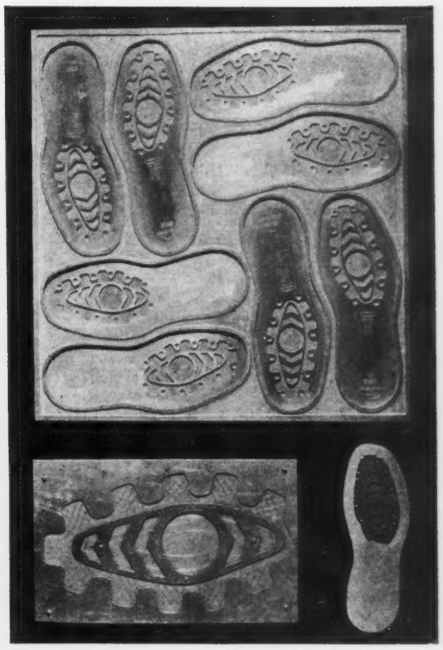
Concavities and convexities of irregular contour can be easily finished through the use of forms that cause the cutter to rise and fall at the same time that it is moved back and forth and from right to left. The form A is the reverse of the concavity or convexity being produced. In the illustration, a trademark is being cut into molds that have been previously hollowed out. The back and forth and right to left movements of the cutter are obtained by moving a style along the flat master copy seen at the right.

Aids the Diemaker

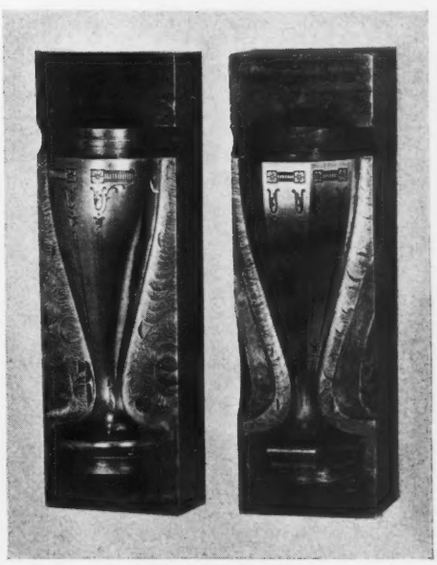


Hard rubber rolls used for marking paper can be engraved on the pantograph-type die-cutting machine. In such operations, a form of the same radius as the roll is used for raising and lowering the cutter when engraving the trademarks. Annular grooves can be cut around the rolls by placing the style that controls the sidewise movements of the cutter successively in equally spaced holes in the master copy. (Below) The finished hard-rubber roll and the master copy used in cutting the trademarks and the annular grooves.

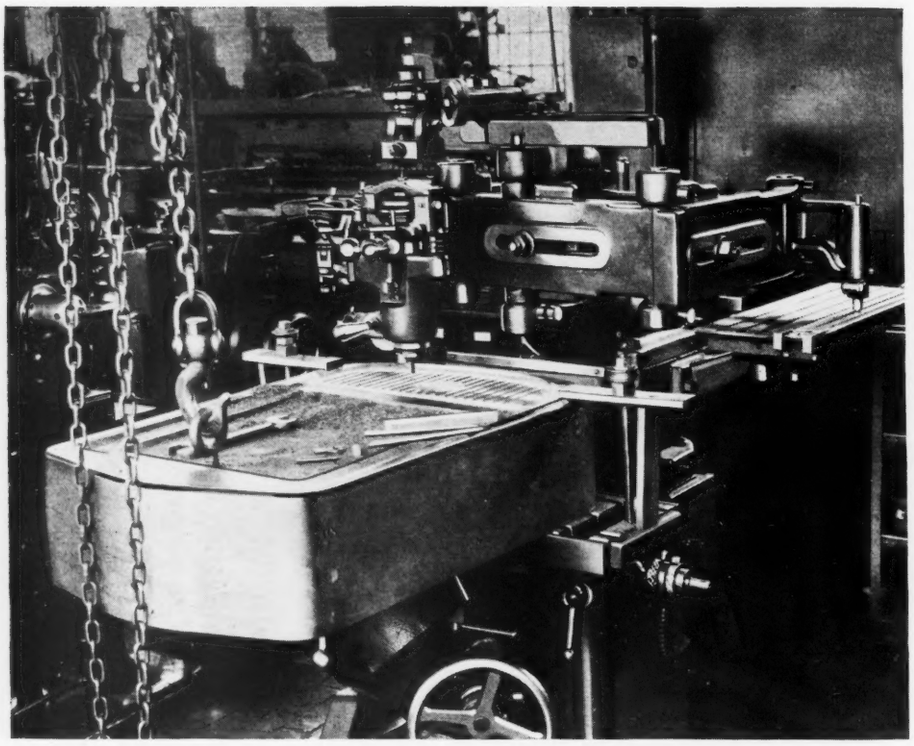




The die-sinker in the shoemaking industry? Here is a steel mold that produces four pairs of rubber-composition shoe soles at one time. In the lower left-hand corner of the illustration may be seen the templet used to guide the cutter in milling the sole designs in the mold. One templet suffices for many shoe sizes.



These hubs for making multiple-cavity die-casting dies for salt and pepper shakers were mounted on dividing-head centers and revolved or indexed for machining to the desired contours. An ordinary flat templet was used to guide the cutter sidewise.

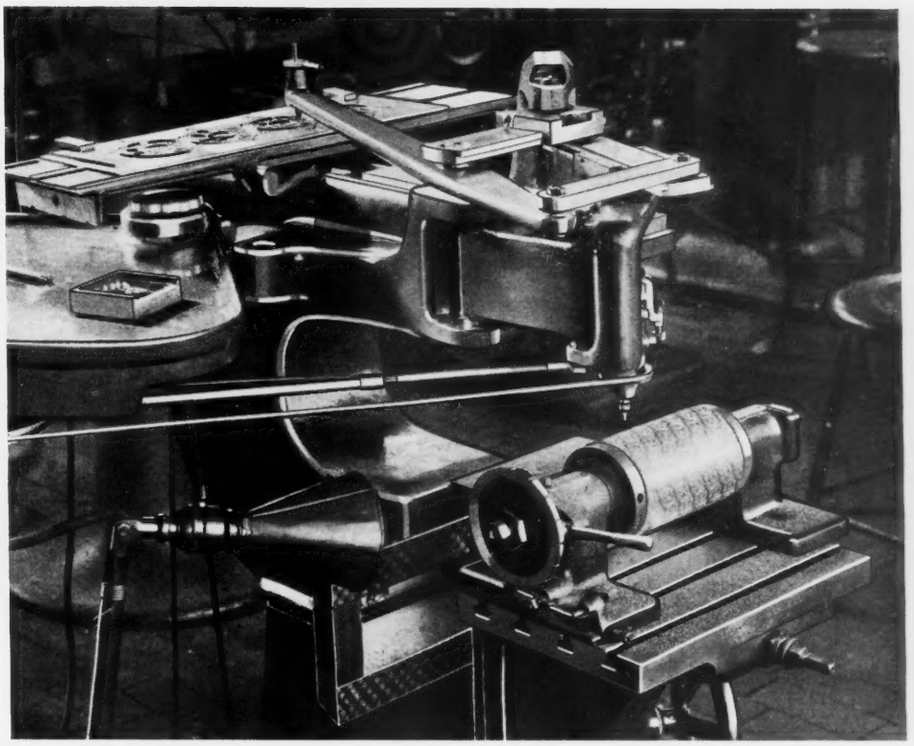


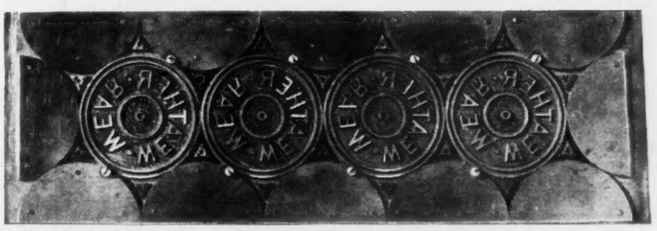
This power press die for automobile radiator shells was handled on a pantograph-type die-cutting machine, because the 1/4-inch cutter used for milling the slots had to be run at speeds much higher than were available on the regular milling machines in the shop. The slot widths were held to size within plus or minus 0.002 inch. The roughing cut was taken with a single-lip tool, and the finishing cut with a fluted end-mill. Straight steel strips on the copy-holder at the right were used to guide the cutter.

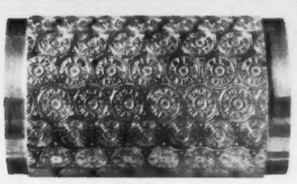
A cast-iron mold for the bottom of glass bottles and a wax impression from this mold. The cavity was first profiled on the pantograph die-cutting and engraving machine, using a round-nose cutter. The letters and trademark were then cut with a half-round cutter ground to an angle of 45 degrees and running at 7500 revolutions per minute. Production time for mold, complete, was 17 minutes.

Molds for glass letters and numbers 3 1/2 inches high, such as are used in electric signs, formerly required four hours apiece to make. By using a pantograph die-cutting and engraving machine, the total time for milling and lapping these molds has been reduced to 20 minutes—a saving in time of 90 per cent. In roughing and finishing, the cutter runs at 6000 revolutions per minute.

Tool-steel rolls with over 100 trademarks are used for stamping the leather soles of shoes. Pantograph die-cutting and engraving machines are employed as illustrated for producing the designs on these rolls. An indexing fixture insures accuracy in spacing the rows of trademarks. One half of the roll illustrated is engraved all the way around, and then the machine table is shifted for engraving the other half. This method is followed because the master copy (shown below) has only four designs.







The leather-sole trademarking roll shown is about 5 1/2 inches long by 3 1/2 inches in diameter. Directly above the roll is the master copy, which has four enlarged trademarks used in cutting more than 100 trademarks in the roll. The pantograph machines insure uniformity of the design and reduce the production time to a fraction of what would be required for hand work.

Whenever the surface being milled or engraved is not flat, form blocks must be used to raise and lower the cutter as it is moved from front to back and from right to left, when the operator guides the style along the path of the flat master copy. The illustration shows a number of form blocks required for operations on a variety of concave, convex, and irregular shaped dies and molds.

Special Tools and Devices for Railway Shops

Recommended by Railway Shop Superintendents and Foremen

Ball-Bearing Lathe Center for Reclaiming Air-Pump Pistons and Rods

By EDWIN G. JONES
Atlantic Coast Line Railroad, Tampa, Fla.

In railroad shops, it is the practice to reclaim worn air-pump steam-pistons and rods many times over until the piston-rod is reduced in size to a point where it is necessary to condemn or scrap it. The life of these pistons and rods is, therefore, very long, provided care is exercised in turning the rod to remove just enough metal to produce a true surface.

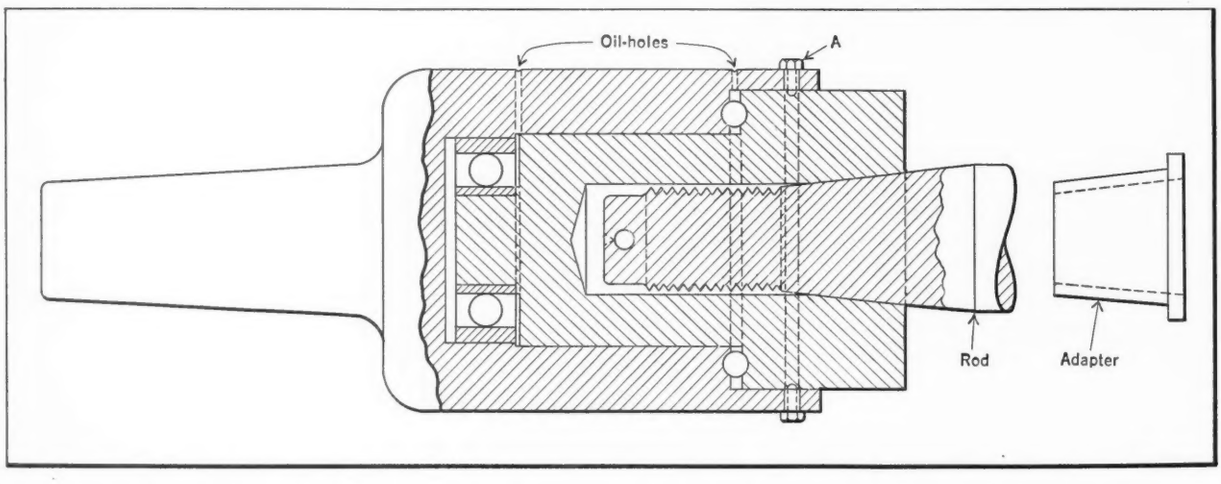
One difficulty in reclaiming the rods is to center their ends correctly so that the rods will run true. Various methods are employed for removing the steam-piston and rod from the air-piston. The most common of these is to strike the end of the rod a blow with a heavy sledge hammer. This usually damages the center hole in the rod, which makes it necessary to re-center the rod—a difficult operation if great accuracy is required.

By using the ball-bearing center shown in the illustration, however, the rod is centered by its tapered surface, and the battered center hole does not affect the accuracy of the work. The construction is obvious from the illustration. The screws *A* engage a groove in the rotating member and hold it in the body of the device. Two sizes of air-pump pistons and rods are reclaimed with this live center, the adapter indicated being used for one size.

Air Cylinders in Floor Facilitate Handling Truck-Wheel Sets

When the treads of truck wheels are to be trued in the Stratford, Ontario, shops of the Canadian National Railways, the wheel sets are carried by an overhead crane to a track that leads to the wheel lathe, as shown in the illustration. From this point each wheel set can be easily pushed to the lathe.

Section *A* of each track rail is hinged at a distance of about 5 feet from the machine. The ends of the rails that extend into the lathe rest on plungers which are raised and lowered by means of a worm and worm-wheels, and these, in turn, are actuated by an electric motor. By this means, the wheel set is lifted to the height of the lathe centers. It can then be conveniently attached to the chucks, after which the rails are dropped into their normal



Live Tailstock Center for Reclaiming Pump Pistons and Rods that have had their Center Holes Damaged

position, so that the wheels can revolve freely during the turning.

Finished wheel sets removed from this machine must be placed on the floor plate at the left, which leads back to the truck erecting section. To swing the wheel sets around 90 degrees so that they can be conveniently delivered to this plate, use is made of an air cylinder in the floor.

First, the axle of the wheel set is positioned over the cradle *C*, which is mounted on the top end of the piston-rod that operates in this cylinder. Then the operator steps on a floor-button to open a valve which admits air to the cylinder. As the piston-rod rises, it carries the wheel set with it. In the raised position, the wheel set can be turned with ease, as the cradle is mounted on a roller bearing. Next, by removing his foot from the floor-button, the operator releases the air from the cylinder so that the piston-rod *B* descends and lowers the wheel set to the floor. The wheel set can then be readily pushed toward the erecting tracks.

A 1/4-inch movement of the floor-button admits sufficient air to the cylinder to raise the piston-rod and the wheel set approximately 15 inches. The wheel sets range from 2800 to 3300 pounds in weight.

O. H.

* * *

Better lighting conditions resulting from clean windows and white walls permit employes to work more hours under natural light and fewer hours under electric light.

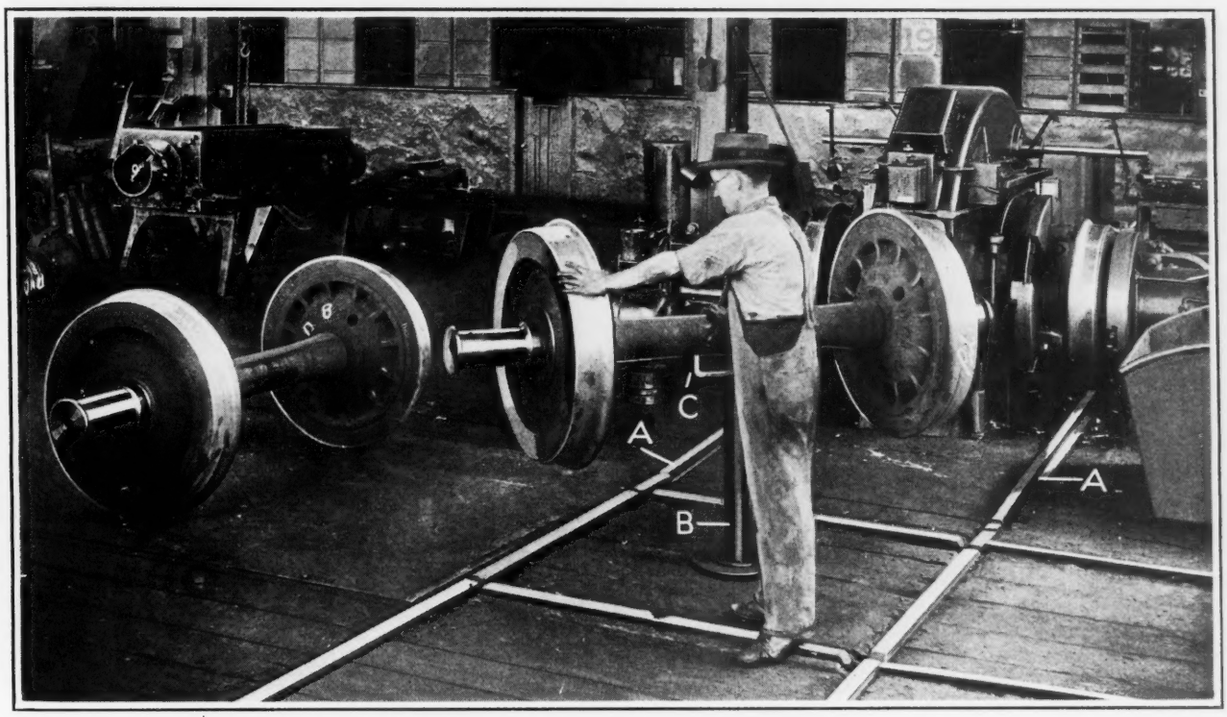
The Better They Make Them, the Fewer are Sold

As a result of improvements in locomotives, fewer locomotives are used. The total number of locomotives in service in 1931 was 5 per cent less than in 1911, but the 1931 locomotives were so superior in pulling capacity that, in spite of being smaller in number, they represented an aggregate tractive power 57 per cent greater. The total number of locomotives in service on the regular railroads in the United States in 1931 was 55,400, as compared with 58,300 in 1911. This reduction has been made possible by replacing old engines with more powerful ones and by the more intensive use of all locomotives in service. The average tractive power of steam locomotives increased from 28,300 pounds in 1911 to 45,800 pounds in 1931.

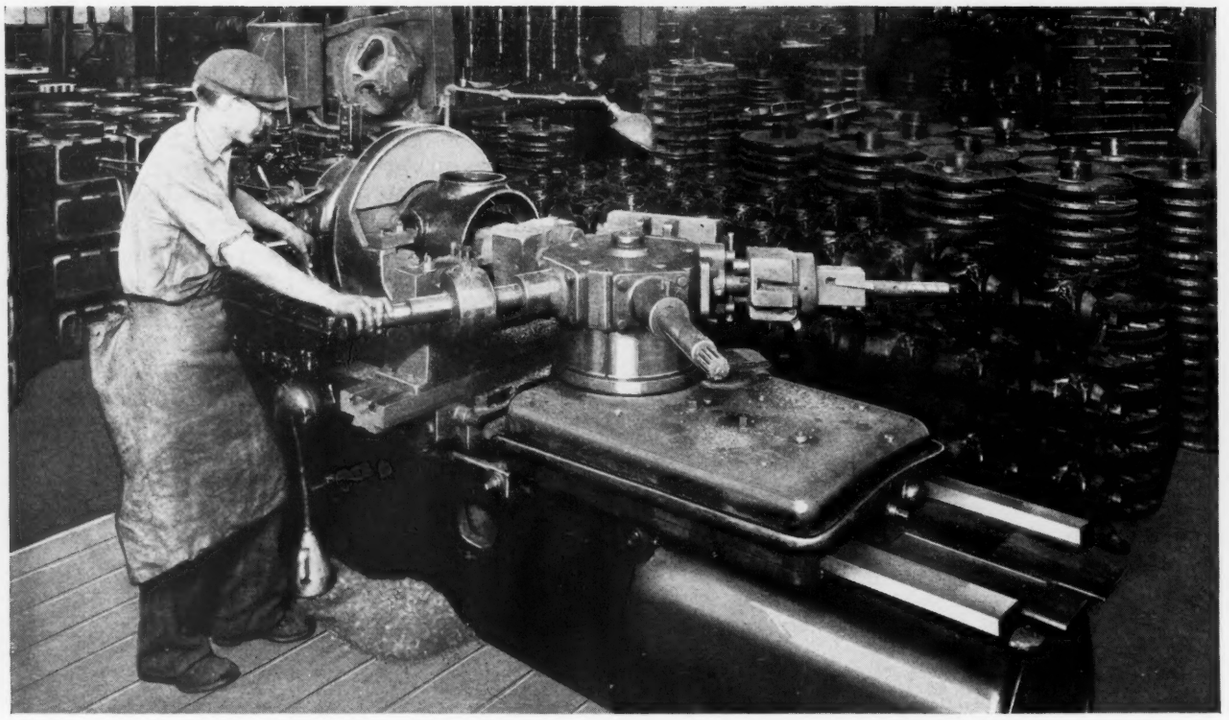
As in the case of locomotives, so the number of freight cars has been reduced in recent years because of the greater carrying capacity of the average car. In 1911, this average capacity was 37 tons, while in 1931, it was 47 tons.

* * *

The new type all-steel film spools made by the Eastman Kodak Co. are automatically assembled and electrically welded at a speed of fifty to sixty a minute in a machine developed by the company's engineers. More than 16,000,000 linear feet of flat strip steel is consumed annually in the production of these spools.



Air Cylinders in the Floor Help the Operator of the Wheel Lathe to Handle the Wheel Sets of Tender and Trailer Trucks



Selecting the Right Cutting Tools in A Modern Machine Shop

Results Obtained on Production Work with Tungsten- and Tantalum-Carbide Tools—Second of Two Articles

By J. M. HIGHDUCHECK
Assistant Superintendent
Westinghouse Electric & Mfg. Co.
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THE results obtained with different kinds of metal-cutting tools were described in the previous article on page 30 of September MACHINERY. The present article continues with examples illustrating the practical applications of tungsten- and tantalum-carbide tools and a brief description of the methods employed in applying tips of these materials to carbon-steel shanks.

Tungsten carbide, when properly applied, will give remarkable results in machining metals such as cast iron, semi-steel, malleable iron, bronze, hard rubber, fiber, and Micarta. In fact, chilled iron castings too hard to be machined with other cutting tools have been readily machined with tools tipped with tungsten carbide.

At a cutting speed of 20 feet per minute, a depth of cut of 1/8 inch, and a feed of 1/2 inch per minute, it was found impossible to machine a one-inch face on the sides of a 16-inch diameter housing with one of the best cutting materials previously available. With a tungsten-carbide tool, however, it was possible to machine this piece readily at a speed of 60 feet per minute. After machining eighteen of these pieces, the cutting edges were still in good condition.

In another instance, the machining of a semi-steel part on a production basis at a surface speed of 90 feet per minute was speeded up by changing to a tungsten-carbide tool. With the latter tool, the speed was increased to 300 surface feet per minute without changing the feed per revolution or the depth of cut. In Fig. 1 is shown a production job performed by the use of tungsten-carbide tools. This job consists of machining a bronze part at a speed of 550 feet per minute, with a feed of 1/32 inch and a cutting depth of 1/8 inch.

Diamonds have been successfully replaced by tungsten-carbide tools for machining Micarta and Bakelite products. A heavier feed can be used with a carbide tool than with a diamond. The cost of the diamond tool is about $125, as compared with $16 for a tungsten-carbide tool. A tip of the latter material can be mounted more firmly in the holder than a diamond, and there is not so much danger of its becoming loosened and lost. Another advantage of the tungsten-carbide tool over the diamond is that a cutting face can be readily formed and regrinding of the tool is easily accomplished.

The ability of tungsten carbide to withstand abrasive action was clearly demonstrated in turning a

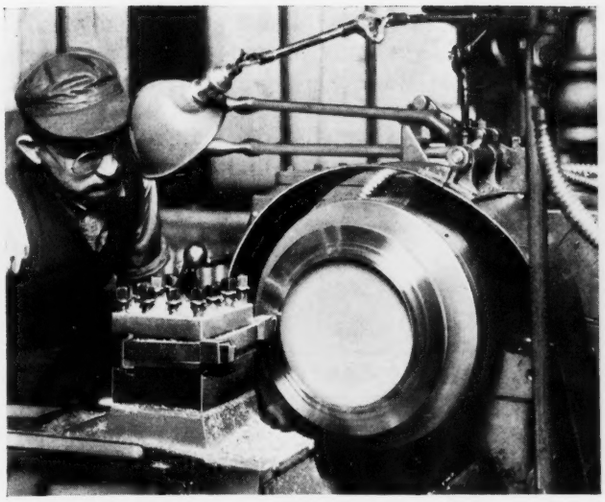


Fig. 1. Machining Bronze with a Tungsten-carbide Tool at a Cutting Speed of 550 Feet per Minute

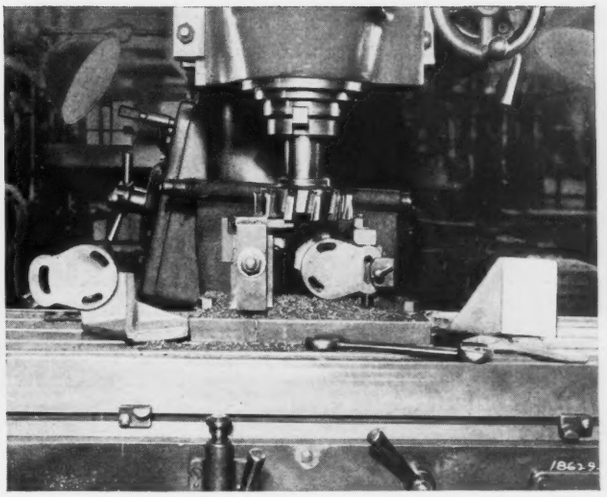


Fig. 2. Milling Cast Iron at a Speed of 225 Feet per Minute with Tungsten-carbide-tipped Cutter

piece of marble, 2 inches square by 12 inches long. With a high-speed steel tool and a cutting speed of 100 feet per minute, it was possible to turn off the corners to a depth of 1/8 inch for a length of 1/2 inch. When turning with a tungsten-carbide tool, the speed was increased to 200 feet per minute and finally to 400 feet per minute, which permitted the two-inch square piece to be turned to a diameter of 1 3/4 inches for a length of 9 inches, using a feed of 1/32 inch. The tool showed no signs of wear upon completing this turning operation. Marble or slate can also be drilled with drills tipped with tungsten carbide.

Many users of cemented tungsten carbide are of the opinion that this material is only applicable to turning and boring tools and that it is not adapted for milling operations. However, where production requirements are such as to permit the use of expensive tools, tungsten-carbide milling cutters can sometimes be applied to advantage. A milling operation performed on cast iron at a speed of 225 surface feet per minute, with a table feed of 32 inches per minute, is illustrated in Fig. 2. With this tungsten-carbide-tipped milling cutter, it is possible to machine four hundred pieces per grind.

Since cemented-carbide cutting tools can be operated at speeds far in excess of the speeds used for high-speed steels, the question of machine tool design must be taken into consideration. The headstock must have closely fitted bearings to eliminate chatter and vibration, and the tailstock must have a minimum amount of overhang. Adequate lubrication must also be provided. It is necessary to transmit more power at the high speeds used for tungsten-carbide tools, and care must be taken to prevent slippage and stalling of the machine. The machine operators should be given full and complete instructions before they are allowed to use tungsten-carbide tools. They should understand the characteristics of this material, and sufficient time must be taken to explain what it is, how it works, and its advantages.

The Development of Tantalum Carbide

Within the past year, much attention has been given to tantalum carbide, both by the manufacturer and by the user of this material. The manufacturer of carbides, knowing the demand for steel cutting tools, has appropriated large sums for research work and, as a result, we find several carbide cutting tools on the market capable of giving much better results in cutting steel than were obtainable in the past. Now

Fig. 3. Machining Silicon Steel with Cemented Tungsten Carbide at a Speed of 500 Feet per Minute

that such materials are available, the question is often asked, can these materials be used profitably at the present time, or will many users experience troubles similar to those encountered when tungsten carbide first appeared on the market?

Sometimes too much enthusiasm decreases the value of new products. On the other hand, ideas presented in an uninteresting way seldom create the enthusiasm necessary for their practical development. Experience is the best teacher, and it is true that many of the so-called failures of cemented carbide can be traced to incorrect applications or, perhaps, to the fact that the user has accepted over-optimistic or exaggerated information, expecting to obtain results without having the required experience.

New ideas create enthusiasm and it is well that they do in many instances. We should bear in mind, however, that what may seem a wonderful accomplishment in one plant may be "just another job" in some other plant. When cemented tungsten carbide was first introduced, both the representative and the user expected too much from this cutting material, and as a result, many of the users lost faith in its cutting capacities. Today, the abilities of both the tungsten- and tantalum-carbide cutting materials are generally known and the only excuse for their failure in any plant is lack of experience in their application.

Now that the value of tantalum-carbide tools in machining non-ferrous products has been recognized, many articles regarding its application are being published. Some of the information is very valuable, while some is misleading and only retards the progress of this cutting material. It is quite true that tools designed to machine materials such as cast iron, semi-steel, etc., cannot be used economically in machining steel. Therefore, before making tantalum-carbide applications, one should consider seriously the various problems involved, the most hazardous of which is chip disposal.

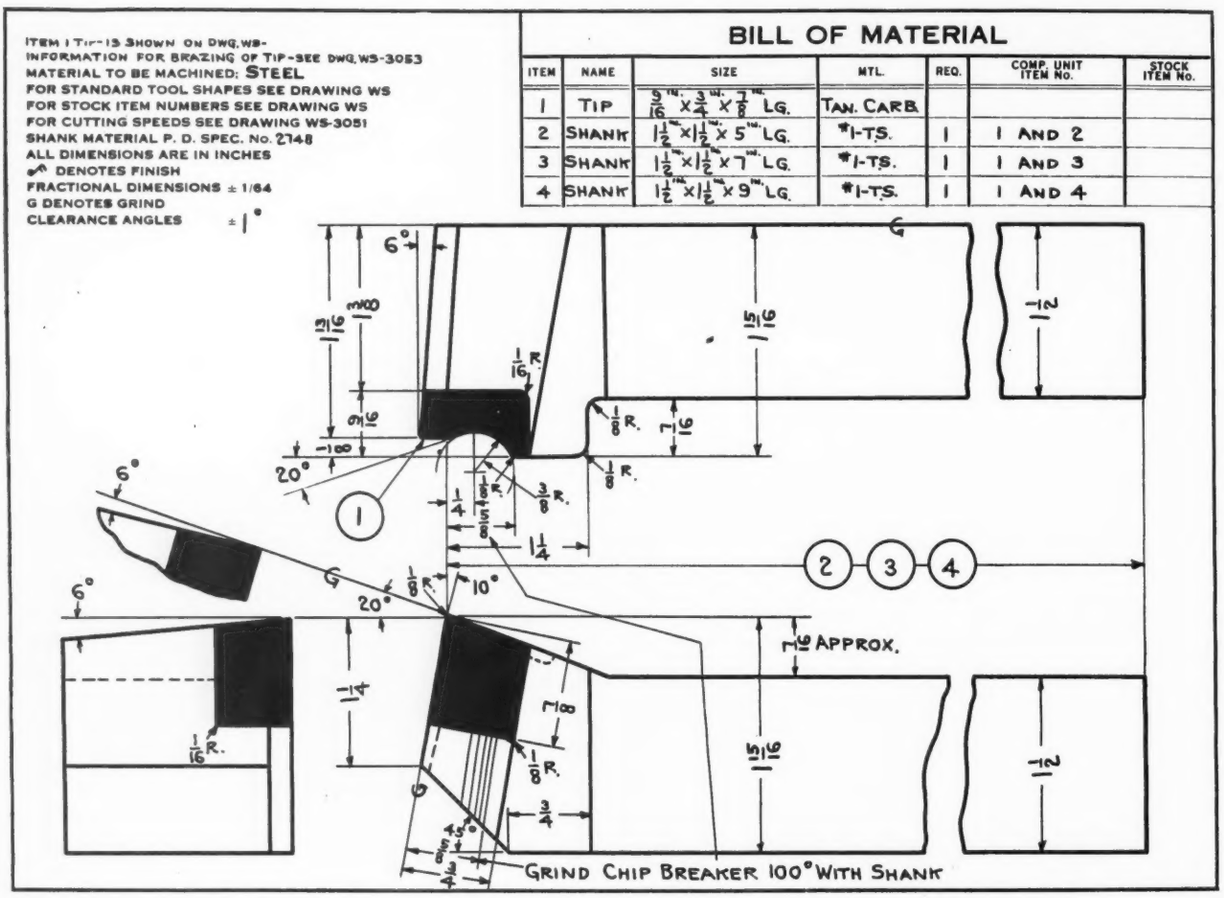

ITEM 1 TIP IS SHOWN ON DWG. WS-
INFORMATION FOR BRAZING OF TIP-SEE DWG. WS-3053
MATERIAL TO BE MACHINED: STEEL
FOR STANDARD TOOL SHAPES SEE DRAWING WS
FOR STOCK ITEM NUMBERS SEE DRAWING WS
FOR CUTTING SPEEDS SEE DRAWING WS-3051
SHANK MATERIAL P. D. SPEC. No. 2748
ALL DIMENSIONS ARE IN INCHES
DENOTES FINISH
FRACTIONAL DIMENSIONS ± 1/64
G DENOTES GRIND
CLEARANCE ANGLES ± 1°
BILL OF MATERIAL
ITEM | NAME | SIZE | MTL. | REQ. | COMP. UNIT ITEM NO. | STOCK ITEM NO.
1 | TIP | 5/16" X 3/4" X 7/8" LG. | TAN. CARB. | | |
2 | SHANK | 1 1/2" X 1 1/2" X 5" LG. | *1-T.S. | 1 | 1 AND 2 |
3 | SHANK | 1 1/2" X 1 1/2" X 7" LG. | *1-T.S. | 1 | 1 AND 3 |
4 | SHANK | 1 1/2" X 1 1/2" X 9" LG. | *1-T.S. | 1 | 1 AND 4 |
6°
20°
10°
45°
APPROX.
GRIND CHIP BREAKER 100° WITH SHANK

Fig. 4. Tool with Cemented-carbide Tip Ground to Break up Chips; Used on Boring Mill for Turning 0.90 Per Cent Carbon Steel at a Speed of 500 Feet per Minute

In Fig. 4 is shown a conventional type of tungsten-carbide-tipped tool with a chip breaker, such as is required in turning steel with tantalum carbide. Tantalum carbide, like tungsten carbide, must be handled with care. The possibilities of this material in machining steel are being recognized more fully every day. The reason that tantalum carbide is more successful than tungsten carbide in machining steel is that it has less affinity for steel. The pressure of the chip against the face of the tip has

less tendency to "crater" its face. It is this action that generally destroys the cutting edge of tungsten carbide and causes the chip to come off straight, instead of as shown in Fig. 3.

The small tips of tungsten carbide and tantalum carbide are brazed to shanks or holders of less costly material. The process of tipping tools with tungsten carbide differs from that used for high-speed and cobalt steel tools. Tungsten- and tantalum-carbide tips are brazed to the shanks with sheet copper about 0.003 inch thick. To insure long life of carbide tools and safety from tip breakage, great care must be exercised in the manufacture of the shanks. The milling of the slots or recesses for the tips is of paramount importance. The bottom of the recess must be flat, and there must be no uneven sides. It is absolutely necessary that the tip be so fitted that it have a full bearing on the bottom of the recess and that it be in full contact with the sides.

One piece of copper is trimmed to the shape of the bottom of the recess and pieces are also trimmed to fit the straight- and radius-formed sides. The tip is set into the recess with the copper pieces in place and secured to the shank with molybdenum wire. A piece of copper wire should always be inserted between the molybdenum wire and the tip, with one end of the copper wire turned upward. This acts as an indicator to show when the copper around the tip reaches the melting point in the brazing furnace. Powdered borax is used as a flux for the brazing operation.

New Pathways Suggested for Industry

In an address on current problems of industrial management before the American Society of Mechanical Engineers, James D. Mooney, vice-president of the General Motors Corporation and president of the General Motors Export Co., referring to the broader viewpoints of industrial management necessitated by present-day conditions, made the following statement:

"Industry, in its endeavor to strengthen its capacity for leadership in its own organization problems, must free itself from the shackles imposed by the over-emphasis of daily-wage rates, and develop a broader and sounder philosophy of compensation. Industry must be free to change wage rates up or down to suit varying business and economic conditions, in order that costs can be adjusted to new market conditions and production maintained at as uniform a level as possible.

"Industry, on the other hand, must face its responsibility of providing greater economic security for its loyal members. Unemployment insurance, health and accident insurance, and old-age pensions may seem to threaten industry with undue burdens of cost, but if industry does not accept a greater responsibility in providing solutions for the problems related to these elements of economic security, then political and labor leaders will. The costs will be far greater. Industry always finally pays the bills.

"Further, from its own standpoint of enlightened self-interest, industry should, and indeed must, take more advantage of the point that if the organization can make the individual feel that his security will be protected by the group, then he will give of himself more whole-heartedly to the interests of the group. A reasonable study of the principles of organization in the various forms of human group movement convinces one that no organization structure can hope for endurance unless it is cemented together with the element of an implied continual relationship between the individual and the group."

* * *

At the National Exposition of Power and Mechanical Engineering, to be held at the Grand Central Palace, New York City, December 5 to 10, several exhibitions will illustrate the research that has led to the development of materials and alloys to meet the service demands of high pressure and high temperature in modern power plants. Many new electrical devices for temperature control will be in evidence. New optical pyrometers will be exhibited, as well as a super-sensitive radiation tube that permits the temperature recording of fast moving objects. The exhibits of piping and fittings developed to meet the present demands of severe service will be of special interest to engineers engaged in power plant design. Other exhibits will include new water-level indicators and high- and low-water alarms.

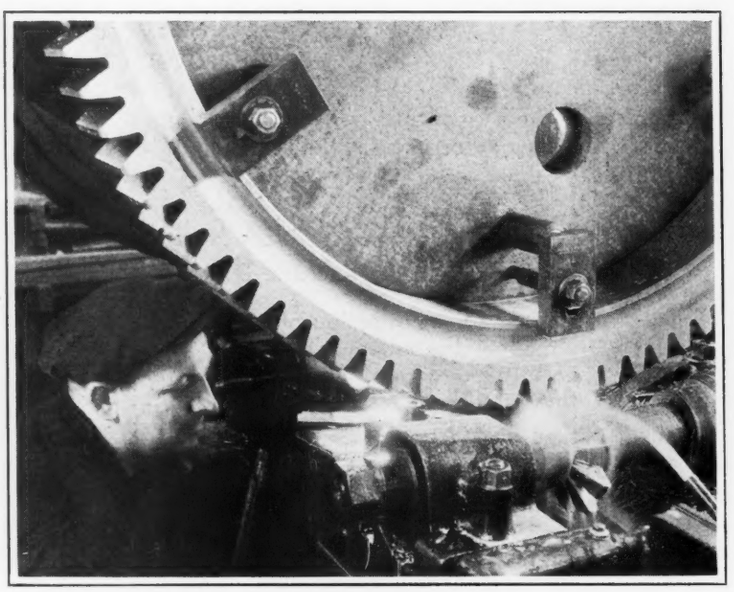
Arc Welding Introduces New Procedure in Machine Design

Before the introduction of welded construction, the engineer's main problem was to so design machine parts that they could be readily cast and would be sufficiently strong at their weakest points to withstand the stresses to which they were subjected. This meant that at many points there was too much metal. With arc-welded construction, the problem is to find out exactly where the metal is wanted and how much is needed for strength and rigidity, without adding unnecessary weight. In December MACHINERY an article will be published outlining how this problem is solved by means of celluloid models. The actual construction then becomes a relatively simple problem, as arc welding provides a practical and economical means of placing the metal exactly where it is required.

Notes and Comment on Engineering Topics

The total number of motor vehicles of all kinds produced in Great Britain in 1931 was 226,307. It is estimated that this year's output will only be about 9000 less than in 1931.

Because of its light weight, aluminum is finding an ever increasing use in railway car construction. The building of coal and ore hopper cars with aluminum bodies will, however, be entirely new to many mechanical men. The Alcoa Ore Co., Pittsburgh, Pa., in December, last year, put into service ten 70-ton hopper cars with aluminum bodies. Each car weighs 38,900 pounds, which is 21,200 pounds less than the weight of a car of usual construction. So far, the cars have given satisfaction.



Cutting what are Believed to be the Most Accurate Gears Ever Made for Railway Service, at the Nuttall Shops of the Westinghouse Electric & Mfg. Co. These Gears are Used on the Pennsylvania New Electric Passenger Locomotives

Aluminum bodies for coal trucks are also being constructed. The body of a large truck for hauling coal and coke used by a coal dealer in Providence, R. I., weighs 2650 pounds, a saving of 1600 pounds over the body formerly used. This gives a chance to haul nearly one additional ton of coal on each trip. Six similar automobile dumping trucks with bodies built wholly of aluminum, except for the hoisting mechanism, are used by the Bureau of Mines in Washington. On these trucks, a saving of 1900 pounds in weight was made. The resistance of aluminum to corrosion is also an important point in its favor.

According to the census figures for 1931 covering the abrasive-wheel and kindred industries, there were, in that year, seventy establishments engaged in the making of abrasive wheels, stones, paper, and cloth. The value of the abrasive products manufactured was $24,776,947. The industry employed, on an average, throughout the year 4570 wage earners.

After more than two years of experimentation, the American District Steam Co., North Tonawanda, N. Y., has produced a protective paint for steam pipes and hot-water lines, which, according to the manufacturer, is impervious to heat generated by steam and immune to the action of moisture, dilute acids, and alkalies. The coat of paint, although very hard, is sufficiently elastic to expand and contract with the pipe without cracking or peeling. The paint is known by the trade name "Adsco Pipe-Kote." It is also recommended for use on gas and water mains, smokestacks, boiler fronts, and on all surfaces that are exposed to changes in temperature and atmospheric conditions.

A huge welded steel car has been developed by the engineers of the General Electric Co. for the transportation of transformers. The new car, except for the trucks, is of welded construction and marks a new departure in freight-car design. Over 5000 feet of welding was used in this car. For testing purposes, the car was loaded with 141 tons of pig iron—11 tons in excess of its designed capacity. With this load, the car was hauled over curves and grades, after which the load was left in

the car for several hours, tests being made for deflection of the structural members. The car met the required tests satisfactorily.

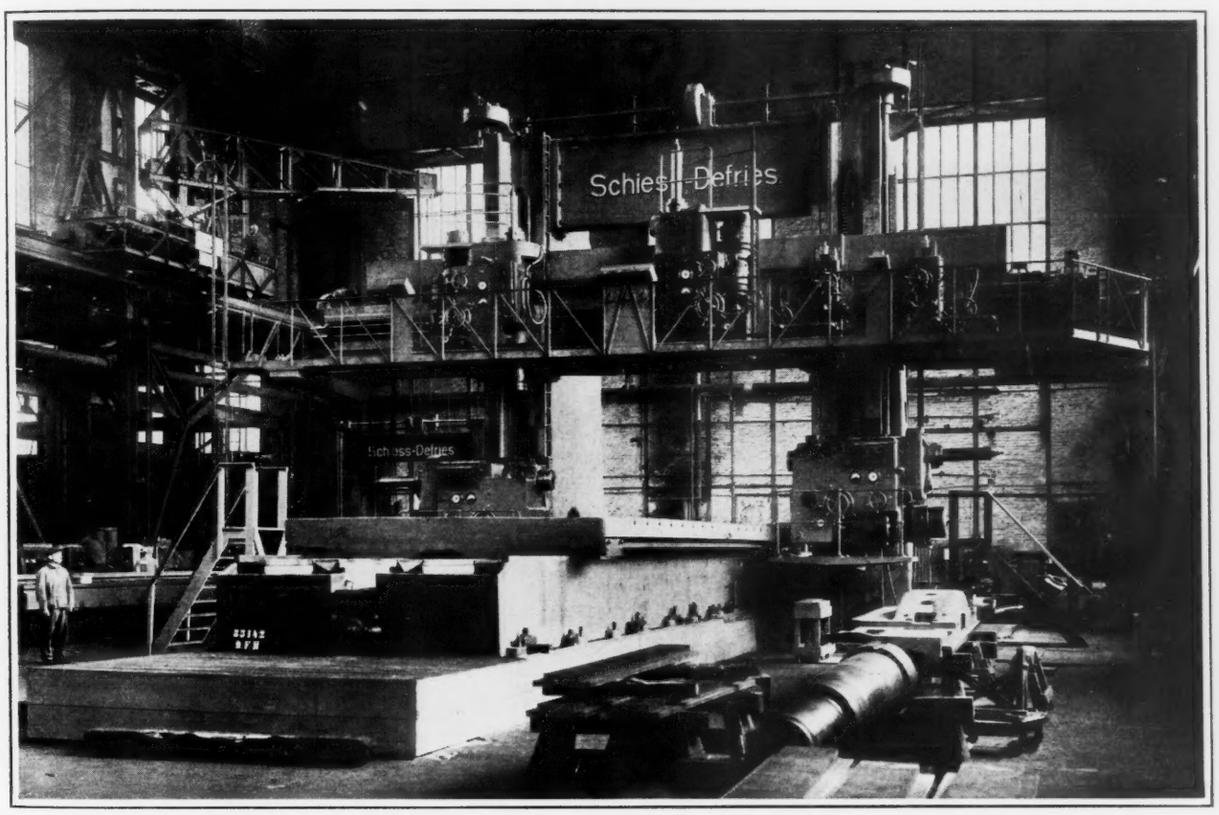
One of the biggest problems confronting the incandescent lamp manufacturer is that of obtaining diamond dies for drawing the fine wire filaments. Trevoux, a little town in central France, supplies the world with most of these dies. Almost the entire population of the town is engaged in this tedious task, requiring unusual patience and skill. All day long they sit at manually operated machines drilling diamond dies of all sizes. Low wages, in combination with a skill founded on years of experience, enable the people of Trevoux to maintain a kind of monopoly in this art.

The great advance of the automatic refrigerator business can be judged from the fact that the Frigidaire Corporation has just completed its 2,250,000th refrigerator for household use. A tremendous amount of steel is used in the manufacture of automatic refrigerators. The Frigidaire Corporation was the first manufacturer of electric refrigerators to change from the wooden to the all-metal cabinet. This change was made in 1926.

A Huge German Milling Machine

The accompanying illustration shows what is probably the largest milling machine ever built. The designers and builders are Schiess-Defries A.G., of Dusseldorf, Germany. The machine weighs 350 tons and is designed for milling work up to 16 feet wide by 16 1/2 feet high. It is provided with four milling heads, each having two separate motors—one for driving the spindle and one for actuating the rapid traverse and the feed.

The machine can also be used for planing, two heads being provided for this purpose with separate control motors. The conversion of the machine into a planer is done through the movement of a few levers. For planing, the table is driven by a variable-speed reversible motor, a separate motor being used when driving the table for milling. The table has a large number of milling feeds and quick-return movements. With the aid of the long-distance push-button control system, the operator can control every movement of the machine from six different panel stations. Electric lights show which tools are in operation.



A Huge Milling Machine Built by Schiess-Defries, Dusseldorf, Germany, Capable of Handling Work 16 Feet Wide by 16 1/2 Feet High, and Weighing 350 Tons—Probably the Largest Milling Machine Ever Built

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Cleanliness and orderliness in the shop not only reduce accidents, but also exercise a marked influence on the quality of the product.

EDITORIAL COMMENT

A remarkably concise review of the principles involved in the foreign trade situation and its relation to tariffs and foreign debts has been published by the National Automobile Chamber of Commerce in a pamphlet consisting of an address made by James D. Mooney, vice-president of the General Motors Corporation. An understanding of sound economic policies, consistently adhered to, is obviously a necessity in both the building up of a permanent foreign trade and in promoting steady domestic prosperity.

Hence, to take stock of the situation, as has been done in the pamphlet referred to, is the first step toward the formulation of such policies as may avoid the pitfalls of the past. The pamphlet is illustrated by charts and diagrams that clearly indicate where we stand at present and suggest the consideration of such modifications as may bring about a more satisfactory condition both in our foreign trade relations and in our domestic industrial activities.

Industry's Stake in The Tariff and Debt Situation

Industrial leaders, economists, and others who have made a careful study of present conditions agree that improved machinery and manufacturing facilities make it possible for a comparatively small number of the total population to produce all the food products and all the manufactured goods that the nation is able to consume. The patient skill and drudgery of industrial production and the hard work of farming have so largely been turned over to the machine that a much smaller number of men than formerly can produce all that our population can consume.

This being the case, how is the rest of the population to be employed? The transformation that has been brought about by the automobile industry may help to answer this question. Only a few hundred thousand men are actually employed in the building of automobiles, yet the industry has created employment for several millions. Garage and repair men, service station men, chauffeurs, taxi drivers, truck drivers, and thousands of others earn their living through the automobile; yet they are not engaged in production. Jobs are provided for several times the number of people actually engaged in making cars and trucks.

We need not all produce manufactured or agricultural products, but it is desirable that all should be gainfully employed. This means that a constantly increasing number of people must be employed in what may be termed "service" activities. The building of roads and bridges, the paving of streets, the making of parks and playgrounds, and the providing of recreational facilities for our population are among the activities to which this surplus labor must be turned.

The New Problems of a New Era Require New Solutions

All this must be paid for, of course, but all improvements that make life more satisfactory are worth paying for. It is better to have everybody employed, earning a good living and able to spend freely, than to have unemployment, charity, a stagnant industry, and a financially crippled farm population.

We are in an entirely new economic and industrial era from that of a generation ago. The new problems must be studied and new solutions found. These solutions are not the same as those that applied to the problems of business thirty or forty years ago. The world will not recover economically and industrially by applying old formulas. The changed conditions must be recognized and the action taken must be made to suit these conditions.

At no time since the introduction of high-speed steel some thirty years ago, has there been so much uncertainty as to what machining speeds and feeds are practicable with various kinds of cutting materials. Changes are taking place almost over night in this branch of the metal-working industry. Therefore, any efforts to formulate standards for cutting speeds and feeds at this time are not likely to prove of permanent value.

Speeds and Feeds Cannot be Easily Standardized

Not only have the new carbide tools completely upset all previous conceptions of suitable speeds and feeds for cutting metal, but the introduction of these new cutting materials has stimulated progress in the use and application of steel tools, and both steel makers and tool manufacturers are now engaged in development work that may result in steel cutting tools that will remove metal at speeds and feeds never expected from such tool materials in the past.

Until this period of flux has settled down to a more stable condition, it will not be possible to lay down any definite rules of permanent practical application.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Mechanism that Returns Lever to its Starting Position when Machine is Stopped

By F. R. ZIMMERMAN

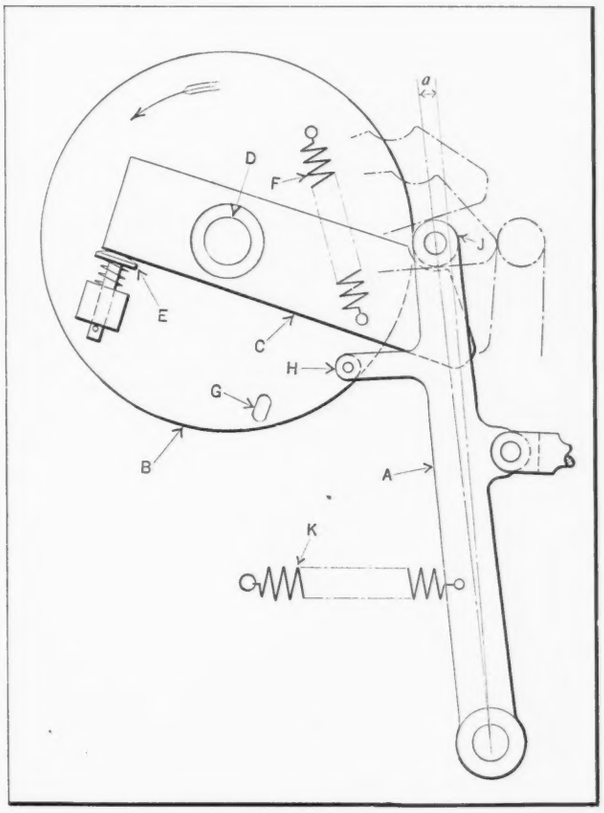
In a certain type of machine, an oscillating lever is required to return to its starting position, or very near it, regardless of the part of the cycle in which the machine is stopped. This lever, which is indicated at *A* in the illustration, controls the movement of an independent feeding device on the machine.

The rather ingenious and simple mechanism shown has been developed by the writer to meet the conditions mentioned. It consists chiefly of a disk *B* which rotates continuously in the direction of the arrow and a cam *C* which is pivoted on the disk shaft *D* and held normally against the spring bumper *E* by spring *F*.

As the disk rotates from the position shown, cam *C* and lever *A* become locked and remain stationary until the lug *G*, secured to the disk, comes in contact with the roll *H* on the lever. Further movement of the disk then forces the lever toward the right, so that the upper roll *J* on the lever will move out of the hooked part of the cam. The remaining part of the stroke of lever *A* is imparted by the cam through the action of spring *F*. As the end of the cam passes roll *J*, the lever is immediately returned to its starting position by the spring *K*.

With this arrangement, it is obvious that the movement of the lever is obtained through a trigger action between cam *C* and roll *J* and regardless of the position in which disk *B* may stop, the lever will always return to its starting position when roll *J* is released.

If, however, the disk is stopped during the angular movement *a* of lever *A*, that is, before the roll *J* is released, the lever also will stop and will not return to its starting position. In the present application, however, the lever does not begin to function until it has moved through this angle, and hence is sufficiently near its starting position to fulfill the conditions required.



Cam-actuated Lever that Always Returns to its Starting Position, Regardless of the Part of the Cycle in which the Machine is Stopped

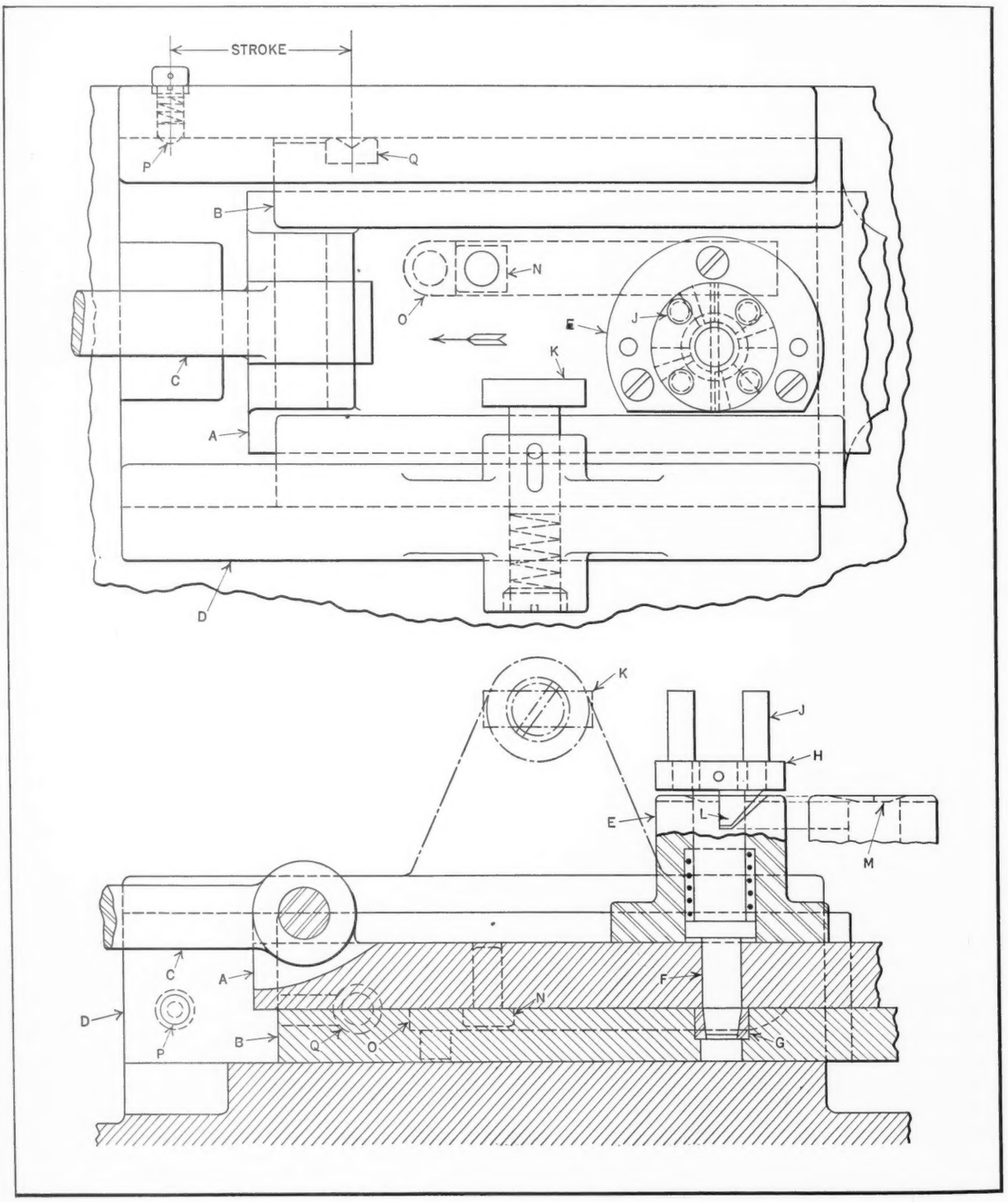
Intermittent Movement of Reciprocating Slide

By J. E. FENNO

Many ingenious slide movements are to be found in the various types of wire-forming machines. One intermittent movement, applicable to these machines, is shown in the illustration (see page 180). In this design, the two adjacent slides *A* and *B* are actuated by the connecting-rod *C*. Slide *A* is connected directly to this rod and is given a continuous reciprocating movement. Slide *B* operates intermittently. For each cycle of the mechanism, slide *B* moves with slide *A* for one working and one return stroke, dwelling for three succeeding working and return strokes.

Both slides operate in the stationary guideway *D*. On slide *A* is mounted a locking device consisting of housing *E*, locking plunger *F* which engages bushing *G*, and cam *H* with its indexing pins *J*. This device is actuated by the spring pawl *K*, which slides in a boss on the guideway.

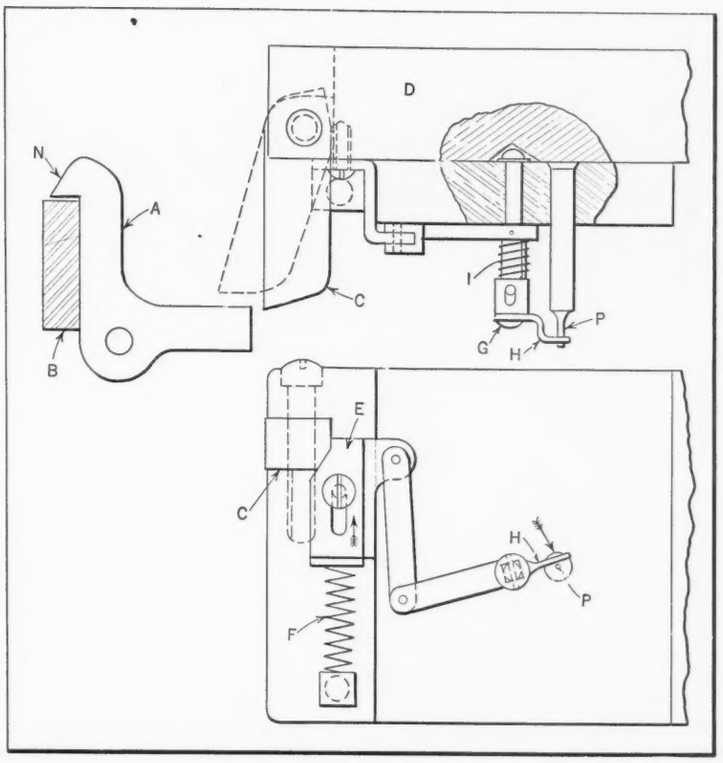
In the position shown, the slides are locked together by the plunger *F*. Consequently, both slides are moving together. They have just completed their working stroke and are about to return in the direction indicated by the arrow. On the return stroke, pawl *K* engages one of the pins *J* and rotates the cam 90 degrees, causing the projection *L* to slide upward along the deep notch in the housing *E* and drop into one of the three shallow notches *M*. This results in the plunger being withdrawn from bushing *G* in the lower slide just before the return stroke is completed. Hence, some means must be provided for completing the return movement of slide *B*. Stops *N* and *O* serve this purpose. As these stops are in contact with each other at this time, the upper stop resumes the task of pushing the



Double Slide Movement with an Arrangement that Causes One Slide to Dwell During a Predetermined Number of Strokes of the Other Slide

lower slide to the end of its return stroke. At this point, spring button *P* engages the depression in the pad *Q* and prevents slide *B* from moving toward the right (during its dwell), due to frictional contact with slide *A*.

For each of the two succeeding working and return strokes of slide *A*, cam *H* is indexed 90 degrees, as previously described; but as the projection *L* enters a shallow notch for all three indexing movements, slide *B* remains stationary for three working and three return strokes of slide *A*. On the last return stroke, however, cam *H* is again indexed. This time the projection enters the deep notch, allowing plunger *F* to drop down and enter bushing *G*. At the end of this return stroke the cycle is completed, and on the succeeding working and return strokes both slides travel together. The object of the shallow notches in housing *E* is to prevent the cam from reversing its movement after being indexed due to the back drag on the pins *J* when they leave the pawl.



Mechanical Device for Stopping Press if Piercing Punch is Broken

Mechanical Device Stops Press if Punch Breaks

By H. R. HAGEMAN

Electromagnetic devices for stopping a punch press by releasing the clutch when the machine or dies fail to function properly have been described previously in MACHINERY. Serious damage to the dies or press is often prevented by such devices. Electromagnetically controlled devices have numerous advantages over the all-mechanical type, but there are times when such equipment is not desirable, especially when it is possible to install a nonmagnetic device that is cheaper and practically as simple as the circuit-closing mechanism required for operating the electromagnet. Such a device is shown in the accompanying illustration. It is designed to stop the press and prevent the work from being spoiled in the event that the small piercing punch *P* becomes broken.

Referring to the illustration, latch *A* is attached to the frame of the press in such a position that the hook *N* will snap over the hand trip-lever *B* or an auxiliary member that operates parallel with the trip-lever when the latter is depressed sufficiently to engage the press clutch. If punch *P* is broken, the dog *C*, which swings freely in an extension of the punch-holder *D*, is pushed outward into the position shown by the dotted lines. On the next down movement, dog *C* trips latch *A* and releases the clutch.

The mechanism by which dog *C* is pushed outward is clearly shown in the illustration. The pressure exerted by the spring *F* is just sufficient to overcome the friction of the moving parts and the weight of dog *C*. Thus the pressure of the finger *H* on the small punch is not great enough to deflect the punch. The direction in which the spring pressure acts is indicated by the arrows.

The cam *E* is used to operate dog *C* in preference to a direct connection with the levers, because any jamming effect on the dog will not be transmitted through the levers to the small punch. Finger *H* is backed up by a spring *I*, and moves up and down along the punch, the knob *G* striking a depression in the stripper plate. The movements are so timed that finger *H* does not touch the strip stock. It is evident that the basic principles here described can be employed in a great variety of lever arrangements that may be designed to suit different conditions.

* * *

Meeting the Unemployment Situation

The employes' representatives of the Schenectady Works of the General Electric Co. have decided to continue, throughout the coming winter, the 2 per cent deduction from wages in behalf of unemployment emergency relief among employes of the company. It was decided to continue the 2 per cent deductions until April 30, 1933, if necessary. The General Electric Co., as before, will contribute dollar for dollar with the employes.

Advances in Grinding Machines to Meet the New Needs of Industry

Equipping for the New Needs of Industry
Section 8

SO many new developments have recently been made in grinding machines that it would be impracticable to attempt to review them all. The improvements briefly referred to in the following paragraphs are representative of those that have been made on practically every type of grinding machine.

The hydraulic principle has been very widely applied. Hydraulically operated surface grinding machines are no longer a novelty. In these machines, the table is reciprocated hydraulically under the wheel, and the wheel-head can be traversed at both ends of the table movement. The table of these machines can be reversed either automatically by dogs or manually at any point of the stroke. The power of these modern grinding machines is best appreciated from the fact that, in one large type, the grinding-wheel spindle is driven by a 75-horsepower motor, while a second motor, of 10 horsepower, is used to operate the hydraulic mechanism.

In the present article, numerous examples will be given to show what production and accuracy are being obtained with modern grinding machines in everyday commercial work.

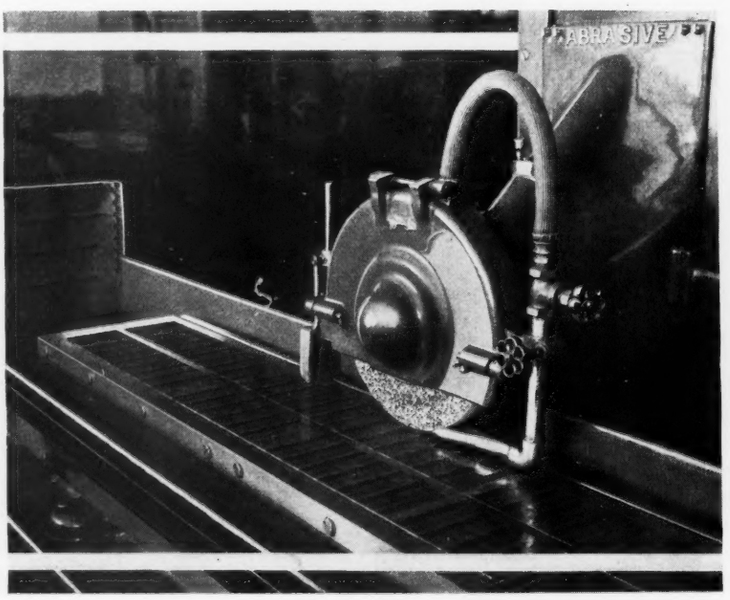
In one case, hardened steel pieces, 1 3/4 inches long, 0.130 inch wide, and 0.0555 inch thick, are ground on four faces with a tolerance of 0.0003 inch at the rate of 200 per hour. The work is done on the surface grinder shown in Fig. 1, at the plant of Frederick Hart & Co., Poughkeepsie, N.Y. These pieces weigh only 1/20 ounce, while the grinding machine weighs 4 1/2 tons. The 60- by 14-inch magnetic chuck holds 2200 of the small pieces arranged as shown in the illustration. Approximately 0.006 inch of stock is removed from each surface.

In one surface grinder, the mode of operation is unusual in that the grinding wheel is passed over the work instead of having the work travel past the wheel. It is claimed that this arrangement enables the operator more readily to determine or "feel" the highest rate of feed at which the wheel is able to cut efficiently. The grinder is especially adapted for the maintenance of punches and dies, as the taper can be reset for duplicating the shear ground on the cutting or punching members. Attachments of various kinds are available for use in grinding cutters, reamers, knives, etc.

A number of unusual features are embodied in another precision surface grinder. The rotor of the motor that drives the grinding wheel spindle is mounted directly on the spindle. There is a double column mounting for the wheel-head. Hydraulic power is employed for feeding the table and work under the grinding wheel and for feeding the wheel transversely across the work.

The sides of metal-cutting saws of hardened steel, in sizes up to 10 inches in diameter, are ground to specifications that sometimes call for limits as close as plus or minus 0.00025 inch on the single-stroke surface grinder shown in Fig. 2. The machine illustrated is one of four used

Fig. 1. Abrasive Machine Tool Co.'s Grinder with 2200 Pieces Held on a Magnetic Chuck for Surface Grinding



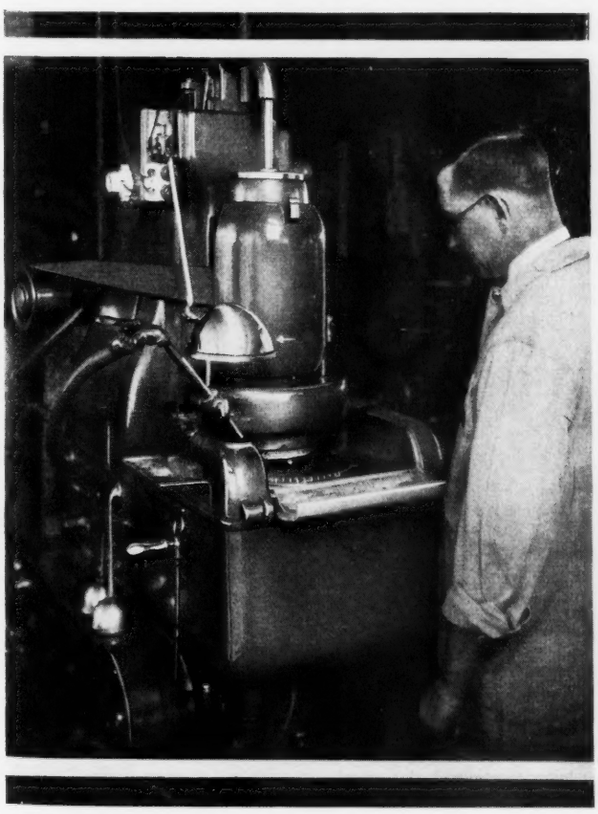
for this work by the Circular Tool Co., Inc., Providence, R. I. The saws are rough- and finish-ground, and are handled one at a time at a steady rate of three an hour.

Surface-Grinding Two Sides of Work Simultaneously

The top and bottom surfaces of Studebaker cylinder blocks are ground simultaneously on the grinder shown in Fig. 3 at the rate of 14 blocks, or 28 finished surfaces, an hour. From 0.010 to 0.015 inch of stock is removed from each of the rough-milled surfaces in this operation. The two surfaces are held flat and parallel within 0.0015 inch and to limits of plus or minus 0.0025 inch for size.

Both sides of locomotive exhaust bases are face-ground so that they will be parallel and will have steam-tight joints by a hydraulic face grinder equipped with a fixture such as shown in Fig. 4. The actual grinding time on two sides is ten minutes, 0.002 inch of stock being removed. These exhaust bases are of cast iron and vary from 20 to 30 inches in height. The ground surfaces of the round flanges vary from 7 1/2 to 10 inches in diameter, and the oblong surfaces are 14 by 9 inches.

Fig. 2. Grinding the Sides of a Metal-cutting Saw on a Walker Surface Grinder within Plus or Minus Limits of 0.00025 Inch



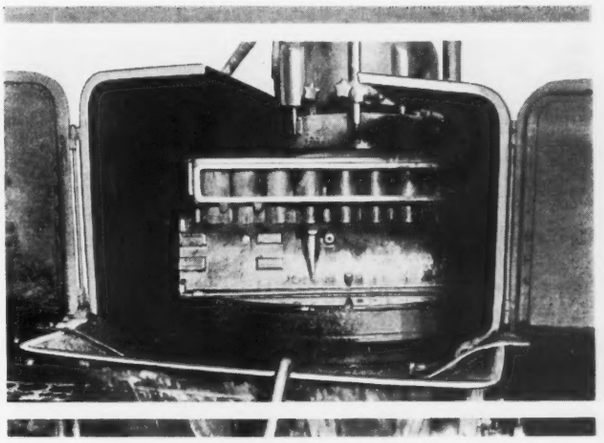


Fig. 3. Grinding Top and Bottom Surfaces of Studebaker Cylinder Blocks on a Blanchard Grinder at the Rate of 14 Blocks (or 28 Finished Surfaces) an Hour

Roller bearings are finished to length, with the ends parallel, by grinding both ends simultaneously on the double-spindle grinder shown in Fig. 5. The grinding is performed on the headed ends of the rivets that project through the end rings of the bearings. The bearings are automatically passed between the two grinding wheels by a power-driven plate with notches around its periphery. A notched shoe holds the bearings in the carrier plate and causes them to make 3 1/2 revolutions in their paths across the wheels. This motion gives the wheels longer life, a faster cutting action, and results in a higher degree of accuracy and finish. The bearing assemblies are about 3 1/2 inches in diameter by 3 inches long. Approximately 0.030 to 0.040 inch of material is removed. The production rate is 40 complete bearings a minute.

Continuous Surface Grinding Machines with Special Work-Holding Means

Continuous-type machines have been developed for grinding flat surfaces on large quantities of rough castings or forgings. The work need not be of any particular shape or thickness, as it is possible to design chucks to handle almost any shape. One large machine is used in a plant manufacturing ball bearings for finishing ball lapping disks which must be reground after relatively short periods of service.

These grinding machines are equipped with a large circular work-holding fixture, which revolves past the abrasive wheel. The chucks carried by this revolving fixture are rotated, in turn, on their own axes by individual motors mounted on the rear of the work-head. While the fixture is revolving, some of the chucks are carrying work-pieces across the

abrasive wheel and other chucks are accessible to the operator, so that finished work can be removed and rough pieces substituted. These machines are built with abrasive wheels as large as 5 feet in diameter.

Surface-Grinding on Machine Equipped with Automatically Dressed and Adjusted Wheels

The cast-iron flywheel housings shown in the lower right-hand corner of Fig. 6 are accurately surface-ground over an area of 30 square inches at the rate of three a minute on the machine illustrated. The ground surface is held parallel with the bottom within 0.002 inch, and flat within 0.003 inch. Three of the castings are mounted on the rotating table at one time.

The castings first pass beneath the roughing wheel, which removes the major portion of the stock, and then beneath the finishing wheel, which produces the required surface and corrects any inaccuracies left by the first wheel. Provision is made for the automatic dressing and adjustment of the wheels. Air-operated calipers gage the work as it leaves each wheel and automatically make any necessary adjustments of the grinding wheels. Thus accuracy is maintained on practically an automatic basis.

Rapid Grinding of Thin Flat Work

As an example of the rapidity with which thin flat work can be ground on a modern vertical grinding machine, it may be mentioned that 10-inch clutch facings are ground at the rate of 1200 pieces, or 2400 surfaces, an hour, on a machine of this type equipped with a non-magnetic table, about 0.010 inch of stock being removed from each side. The work is held to limits of plus or minus 0.0015 inch.

Work is rough- and finish-ground successively in a new automatic surface grinding machine provided with two grinding wheels. Each wheel is maintained at a fixed height by an individual control caliper. This caliper gages the pieces as they leave the wheel and causes the wheel feed to operate as required, in order to maintain the specified work size within close limits.

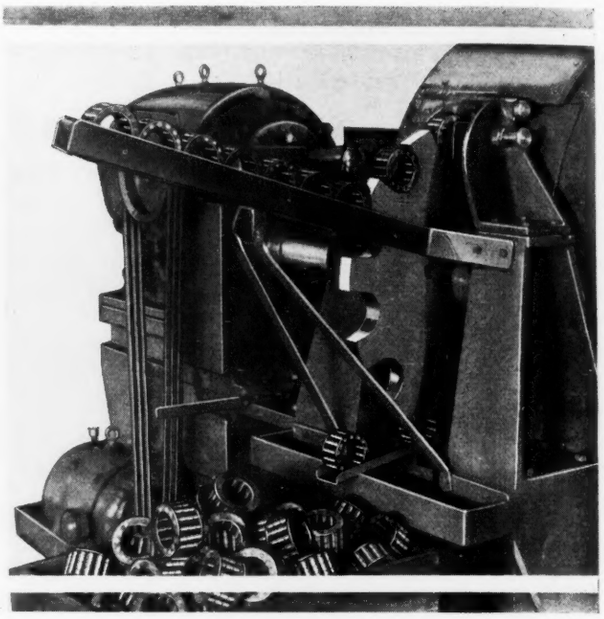
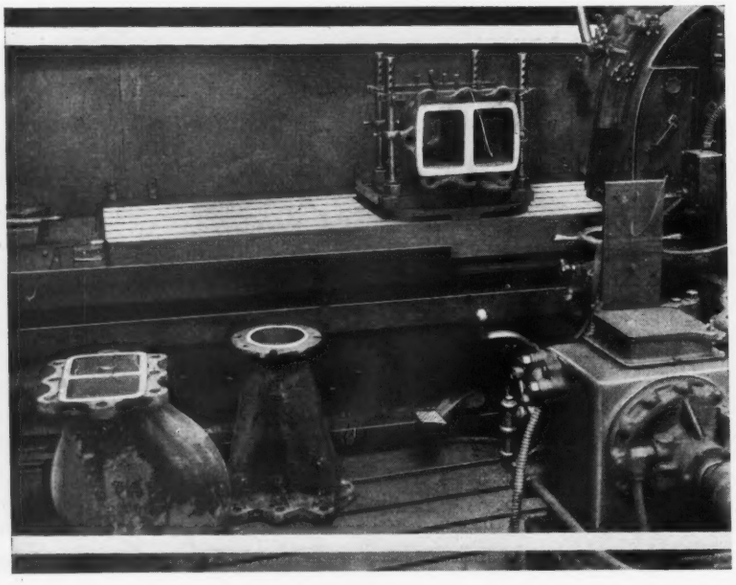


Fig. 5. Grinding Both Ends of Roller Bearings on Hanchett Mfg. Co.'s Badger Grinder at the Rate of 40 Bearings a Minute

Fig. 4. Grinding Both Sides of Locomotive Exhaust Bases in 10 Minutes at Billerica Shops of Boston & Maine R.R., on a Bridgeport Safety Emery Wheel Co.'s Hydraulic Face Grinder



Equipping Standard Machines for High Production

Remarkable progress has been made in developing work-carriers and fixtures to increase production on standard machines used for grinding flat surfaces. In one plant, a machine of the two-spindle type is provided with a simple hand-operated device for placing the work between the grinding members. An area of 4 square inches is ground on each side of the casting and about 1/8 inch of stock is removed over all. The sides of

these parts are finished parallel and flat within plus or minus 0.003 inch, and the width dimensions are held to size within plus or minus 0.003 inch. The production averages 300 pieces an hour. In another fixture, both sides of steel steering-gear half-nuts are ground simultaneously at the rate of three to four a minute.

In still another case, a semi-automatic single-disk machine is provided with a continuously rotating drum having eight stations for finishing one face of small iron castings. This operation is performed at the rate of 720 pieces an hour. An area of 2 1/2 to 4 square inches is ground on castings of different sizes, and 1/32 inch of stock is removed.

An automatic grinding machine is available that will grind all six sides of hexagonal nuts in three passes between two abrasive wheels. At the completion of the operation, the nuts are discharged automatically from the machine. Brass nuts 1 5/16 inches across flats are finished complete at the rate of 30 a minute, or 1800 an hour. Steel nuts 2 3/8 inches across flats are finished at the rate of 12 a minute, or 720 an hour.

Inner and outer races for taper and parallel roller bearings from 6 to 20 inches in diameter are ground on a plain grinding machine equipped with a special headstock, as shown in Fig. 7. The headstock, work-holding means, and operating controls are arranged to assure easy operating conditions and accurate work. The motor used on the headstock is of the adjustable-speed type, giving headstock speeds from 9 to 28 revolutions per minute. A typical inner race, 12 inches in diameter with a 3-inch face, is shown being ground to a gage fit, 0.030 inch of stock being removed at a production rate of 15 pieces an hour.

A full automatic grinding machine equipped with a loading chute and work-drum, as shown in Fig. 8, has replaced three manually operated grinding machines for grinding parts such as shown in the delivery chute. The machine has effected a considerable reduction in production cost, without sacrifice of finish or accuracy and with increased earnings for the operator.

The piece ground is a small shaft with a hole running through it that is required to be concentric within 0.001 inch. From 0.018 to 0.20 inch of stock must be removed and a high finish produced. With the old machines, the prac-

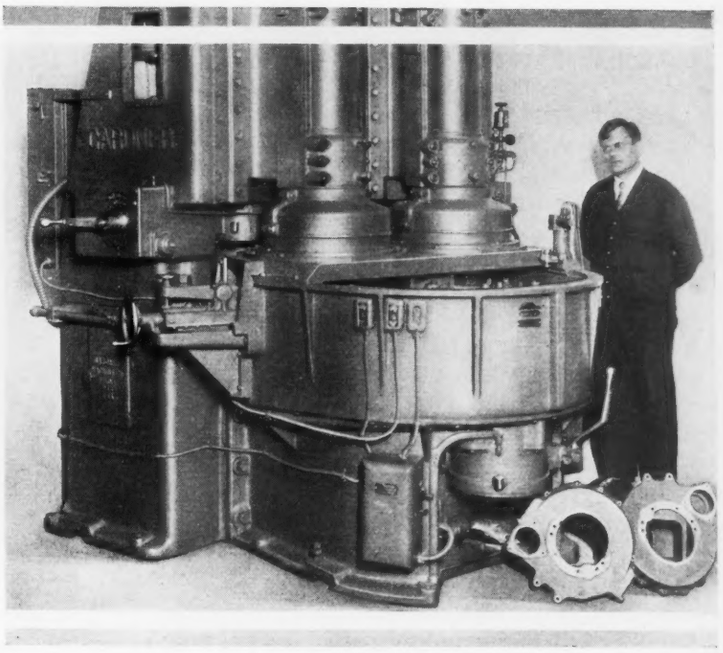
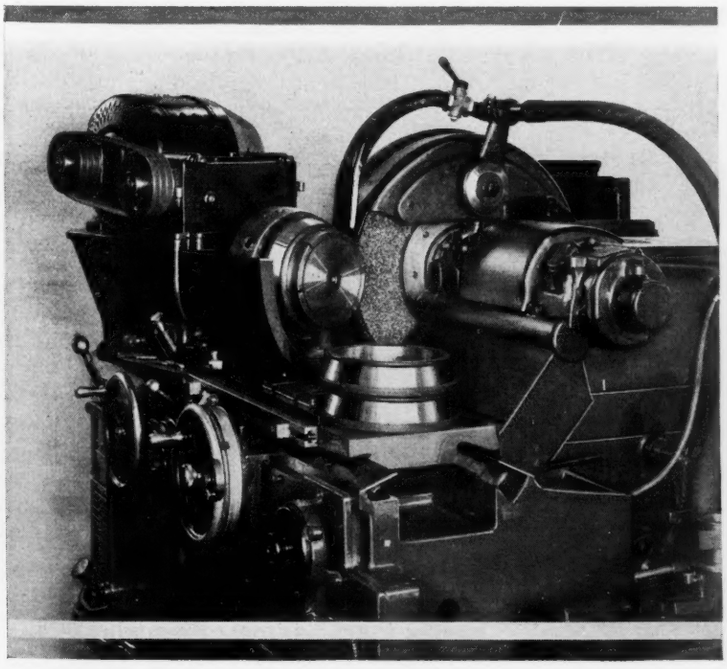


Fig. 6. Gardner Duplex Vertical Grinder Employed for Surface-grinding Flywheel Housings at the Rate of Three a Minute

Fig. 7. Grinding a Gage Fit on Roller Bearing Races 12 Inches in Diameter with 3-inch Faces at the Rate of 15 an Hour on a Brown & Sharpe Plain Grinding Machine



tice was to grind each piece on an arbor. While the finish and accuracy were satisfactory, the rate of production was necessarily slow, despite the skill of the operators.

The new machine eliminates the necessity for using an arbor and gives a finish that is considered slightly better than that obtained with a manually operated machine, at the production rate of 468 pieces an hour. Out of a random lot of 1673 pieces, all but four were found well within the required limits for concentricity. The wheel cost of the new machine is low—about 5 cents a thousand pieces. The wheel will grind between 350 and 400 pieces per dressing. Although the piece rate has been reduced 50 per cent, the operator of the machine has increased his earnings by 50 per cent. One operator can run two machines if necessary.

Two-Wheel Cylindrical Grinder Finishes Two Surfaces Simultaneously

Some cylindrical grinding machines are now arranged for grinding two adjacent cylindrical surfaces of different diameters simultaneously by mounting two grinding wheels of corresponding diameters on the wheel-spindle. Wing-shafts for hydraulic shock absorbers are ground in this way, although there is a difference of approximately 1 5/8 inches between the two diameters. One face of the largest wheel is dished to permit the smaller wheel to project into the larger a certain amount. This arrangement permits of grinding the shaft of the work close to the shoulder formed by the two wings. Both surfaces are ground within plus or minus 0.0003 inch at the rate of 120 parts an hour.

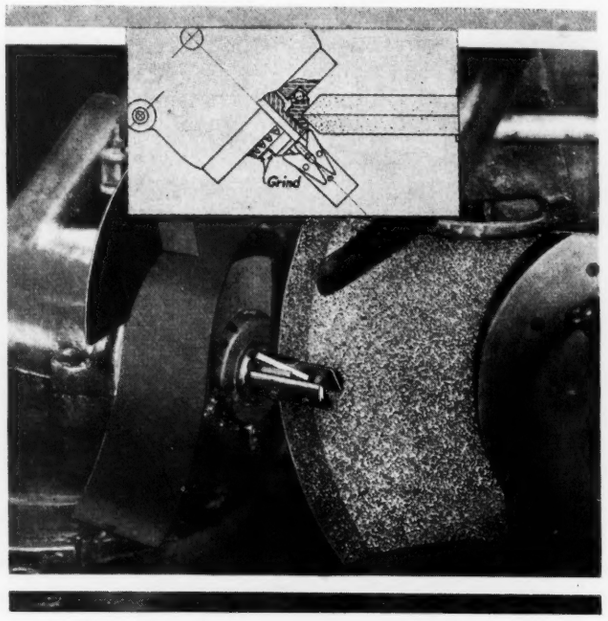


Fig. 9. Grinding Simultaneously the Hub and Face of a Differential Side Gear in a Landis Semi-automatic Hydraulic Grinding Machine

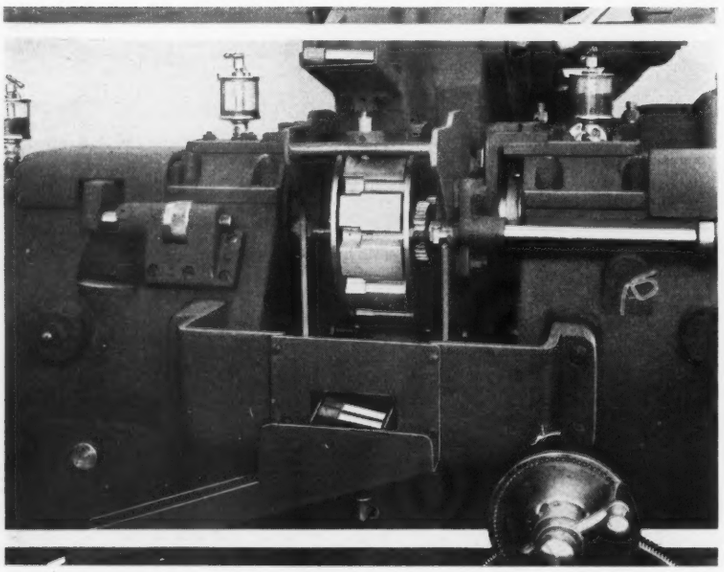
Grinding Hub and Face of Differential Side Gears Simultaneously

Both the hub and the face of differential side gears are ground simultaneously on a semi-automatic hydraulic grinder equipped for holding the work as shown in Fig. 9. From 0.010 to 0.015 inch of stock is removed within limits of 0.0015 inch. The material is S A E 2315 steel, and the production, 140 gears an hour. Before the installation of this machine, the hub was ground on one machine and the face on another machine, only 60 gears being completed in an hour with the two machines and two operators.

The work is held on the arbor by a special draw-rod and clamp, and is centered by steel balls that make contact on the pitch line of the gear teeth. The draw-rod of the clamp is operated by air pressure and is controlled by a conveniently located hand-lever. This clamp eliminates the C-washer arrangement generally used.

After a gear is placed on the arbor, the air valve at the top of the head is opened, causing the clamp to function. A foot-pedal is then depressed, which moves the slide toward the wheel. Rotation of the work is started automat-

Fig. 8. Work-loading Fixture and Adjustable Spindle Stop on a Norton Full Automatic Grinding Machine in which 468 Pieces an Hour are Ground at Greatly Reduced Costs



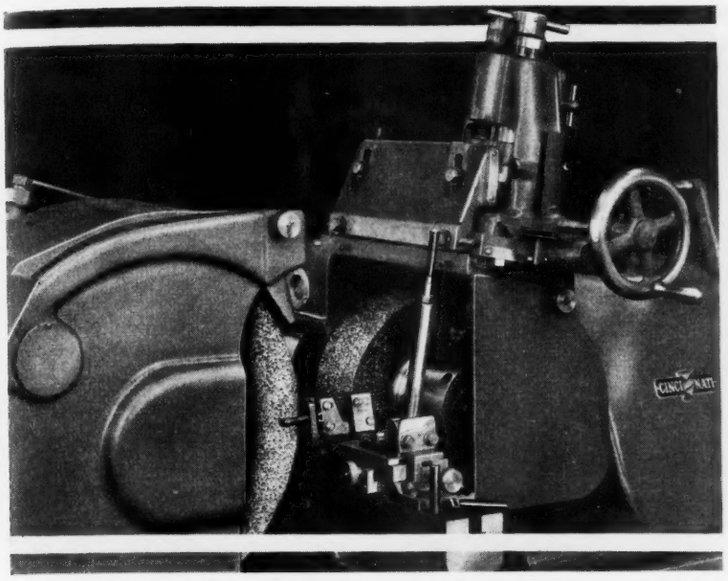


Fig. 10. Grinding Fountain Pen Caps and Bodies Concentric with Hole at the Rate of 500 an Hour on a Cincinnati Centerless Grinder

ically as the work advances. The speed of the feeding movement is slowed down to a predetermined grinding speed as the work reaches the wheel. When the work-slide reaches a positive stop, a timing mechanism acts to hold the slide stationary a predetermined length of time, after which it returns automatically and rapidly to the starting position. Rotation of the work-spindle is stopped automatically on the return movement.

Rubber fountain pen caps and barrels are ground to size and shape from the rough stock in one cut on a centerless grinder equipped as shown in Fig. 10. The pivoted mandrel principle with limited lateral motion is utilized. The barrel or cap is placed on the mandrel, which is lowered between the grinding and the regulating wheels. The required form is generated on the grinding wheel face by means of a cam arrangement. This method of grinding insures concentricity between the hole and the outside diameter of the piece.

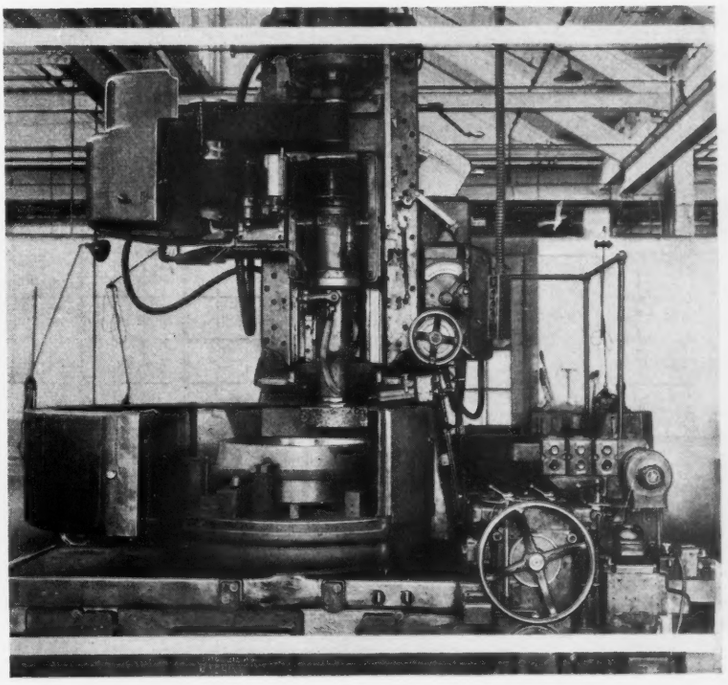
A production of 500 pieces an hour is obtained on this operation, as compared with 200 an hour by polishing and buffing methods. One operator on the centerless grinder does the same amount of work in 161 hours, at a cost of $96, that he formerly did in 331 hours at a cost of $190, and the centerless grinder occupies but one-third the floor space of the previous equipment. The quality of the work has also been improved.

Increased Accuracy of Internal Grinding Machines

In reviewing recent developments in the design of automatic internal grinding machines, attention should be called to the accuracy obtainable with present-day methods. When a "sparking out" device is used, holes can be ground on a production basis with an average out-of-roundness of only 0.00005 inch. It is now easier to grind a hole to this degree of accuracy than it is to measure the error. Through the application of ball bearings, speeds from 10,000 revolutions per minute for 1-inch spindles and larger, up to 25,000 revolutions per minute for 7/16-inch spindles are being employed.

Internal grinding machines have been built in much larger sizes than formerly. On some of these, work up to 3 feet in diameter can be swung over the table, and bores upward of 2 feet in diameter can be ground.

Fig. 11. Grinding a 24-inch Diameter Taper Roller Bearing Race on a Heald Vertical Grinder Designed for Work Too Large to be Held on Regular Horizontal Machines



Grinding Air-Tight Joints on Rock Drill Parts to Very Close Tolerances

The irregular contour and face surfaces of rock drill hammer adapter plates, such as shown at *A* and *B*, Fig. 12, are ground at the rate of 10 minutes a piece at the plant of the Worthington Pump & Machinery Corporation, Harrison, N. J. The tolerance on the work is 0.0005 inch on the center diameter and 0.002 inch on the face. About 0.030 inch and 0.025 inch of stock, respectively, is removed from the contour and face surfaces of these plates.

The machine is equipped with a special worm-drive head that rotates the work three revolutions per minute, and with a work-holding fixture fitted with the special master cam *C*, the accuracy of which determines the accuracy of the irregular or profile surface. When a finished piece with a cam or profile surface, such as the one shown at *B*, is available, it is used in making the master cam. This is done by mounting the finished piece in the work-holding chuck, putting a roll on the end of the driving spindle, and attaching a special grinding wheel head to the wheel-slide box. The roll on the grinding spindle serves to guide the grinding wheel so that it will produce the required contour on the master cam *C*.

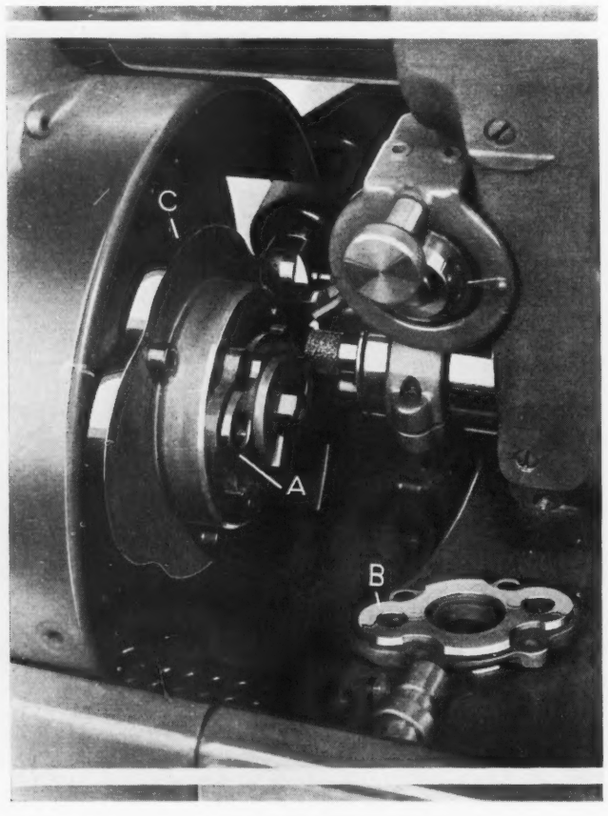


Fig. 12. Bryant Grinder Set up for Grinding Irregular Contours and Face of a Rock Drill Hammer with a Diameter Tolerance of 0.0005 Inch

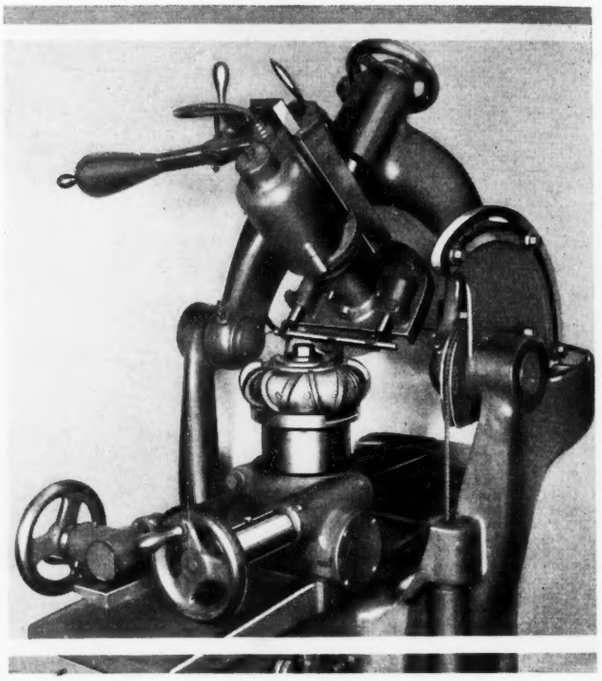


Fig. 13. Grinding Convex Form Cutter on an Ingersoll Cutter Grinder with Drive Direct from a Motor which is Part of the Wheel Assembly

Light Weight of Present Portable Grinding Equipment Facilitates Tool Work

Portable air grinders small enough to be handled with extreme ease have proved of great value in tool work. One of these grinders weighs only 2 1/2 pounds and is less than 10 inches long. It runs at a speed of 30,000 revolutions per minute. Magnesium die-castings are used for some parts of this grinder to make the equipment as light as possible.

Another small air grinder of light weight runs at speeds of over 60,000 revolutions per minute.

Grinding Radius-Milling Cutters on Machine Designed for Wide Range of Operations

Face-, angular-, and radius-milling cutters of practically every conceivable form are ground on the cutter-grinder shown in Fig. 13. Convex radius-milling cutters like the one shown, for example, are ground by swinging the yoke on which the grinder is mounted in an arc over each cutter tooth. Half of the teeth are ground at the first setting, after which the cutter is turned over for grinding the other half. This grinder has a capacity for sharpening face-milling cutters from 5 to 30 inches in diameter with faces up to 7 inches in width.

Power Presses Offer New Possibilities in Production Work

Equipping for the New Needs of Industry
Section 9

RECENT years have seen many new developments in the design and construction of power presses. A few of these are briefly touched upon in the present article. Among the improved features, one that is easily recognized by the casual observer is that automatic feeds of various types, designed to reduce work-handling to a minimum, are being more generally provided. These automatic feeds, which were formerly applied mainly to small or medium-sized presses, are now provided on double-action toggle drawing and deep-stamping presses as well. In one instance, a press weighing 40,000 pounds is provided with such an automatic feed. With this press, shells up to 7 1/2 inches deep can be drawn and automatically lifted out of the dies.

The press shown in Fig. 1 is equipped with an automatic feed that carries blanks from the magazine at the left to the first die station and advances them successively through the remaining six stations without any attention from the operator. Thus, a completely formed and pierced shell is delivered into a receptacle at each stroke of the press. All that the operator has to do is to keep the magazine supplied with blanks. The work performed at each die station is shown by the pieces on the front of the machine bed.

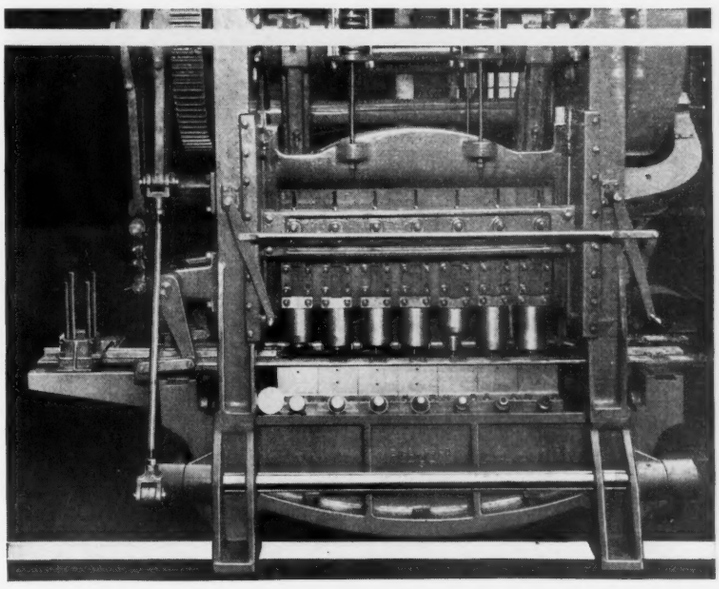
The direct motor-driven presses shown in Fig. 2 are equipped for completely forming patented can tops, including cutting and inserting parchment disks, at the rate of 90 a minute. The equipment includes automatic dial and roll feeds and transfer and conveyor mechanisms.

The can-opener blade shown at the right in Fig. 3 is produced in one pass through a six-station progressive die used on the 50-ton dieing machine shown in Fig. 4, which is operated at a speed of 100 revolutions per minute. This equipment eliminates five of the six operations previously required. The work performed in the five stages preceding the final forming stage is indicated by the strip of stock shown at the left of the finished blade. These blades are made from 0.50 to 0.60 per cent carbon steel purchased in coil form and in the annealed condition. Although the machine shown in Fig. 4 has a double roll feed and scrap cutter, the work requires only a single roll feed, as no material passes through the roll feed on the discharge side.

Improvements have also been made in the control of presses. On one press, for example, there are four methods of operation available: The master control, located on the right-hand upright, contains an emergency stop-button for stopping the press instantly at any point in the stroke. A second button is used for jogging or "inching" the slide when setting dies. A third button, which can be turned to two positions, provides either for single-stroke operation, in which case the press stops automatically at the top of each stroke, or for continuous operation.

In heavy drawing operations on power presses, trouble is sometimes experienced by lost mo-

Fig. 1. Bliss Press with a Seven-station Follow-die, Magazine, and Reciprocating Feed that Delivers a Formed and Pierced Shell at Every Stroke



tion in parts of the mechanism, causing sufficient play between the die members to spoil the work or break the die. With a view to overcoming this difficulty, four-point suspension presses have been developed. In these machines, two crankshafts and four pitmans are used for reciprocating the slide. The pitmans are so arranged that one pair balances the pressure of the opposite pair. As a result, the slide and upper die member move down on the lower die member without any sidewise pressure or movement.

Presses of tremendous size and power are one of the developments that may be attributed to the automobile industry. Many features of design have also been introduced that make the modern press quite different from earlier types. The introduction of both large and small presses having all-welded steel frames has been unusually rapid. Presses up to 350 tons have been made in this manner. In these, the bed uprights, crown, slide, and twin gears are all made of welded steel.

Recently a press manufacturer built a press weighing approximately 250 tons for a leading automobile company. This huge press required six railroad cars for shipment. Instead of the customary single shaft with two cranks located in the center of the slide, it is provided with twin shafts and has four cranks at the extreme corners of the slide. This press, in fact, is large enough to accommodate a completely assembled automobile between the bed casting and the ram. The flywheel alone weighs five tons, and the bed casting, which weighs over fifty tons, has an over-all length of over 18 feet. The press has a capacity of 600 tons.

A 1500-ton vertical hydraulic press of giant proportions was recently built for hot-forming ends of tanks and similar work. This machine is equipped with three rams and is especially designed for flanging or forming heavy metal parts. The main ram exerts a pressure of 1000 tons, while two auxiliary rams provide a pressure of 250 tons each. Hence the press can be used as a triple capacity machine, that is, for operation at a pressure of 500 tons, 1000 tons, and 1500 tons. Also, 500 tons pressure can be supplied for clamping work and 1000 tons for drawing. This press measures 8 by 7 feet between the tie-rods, has a maximum opening of 6 feet, and a stroke of 4 feet.

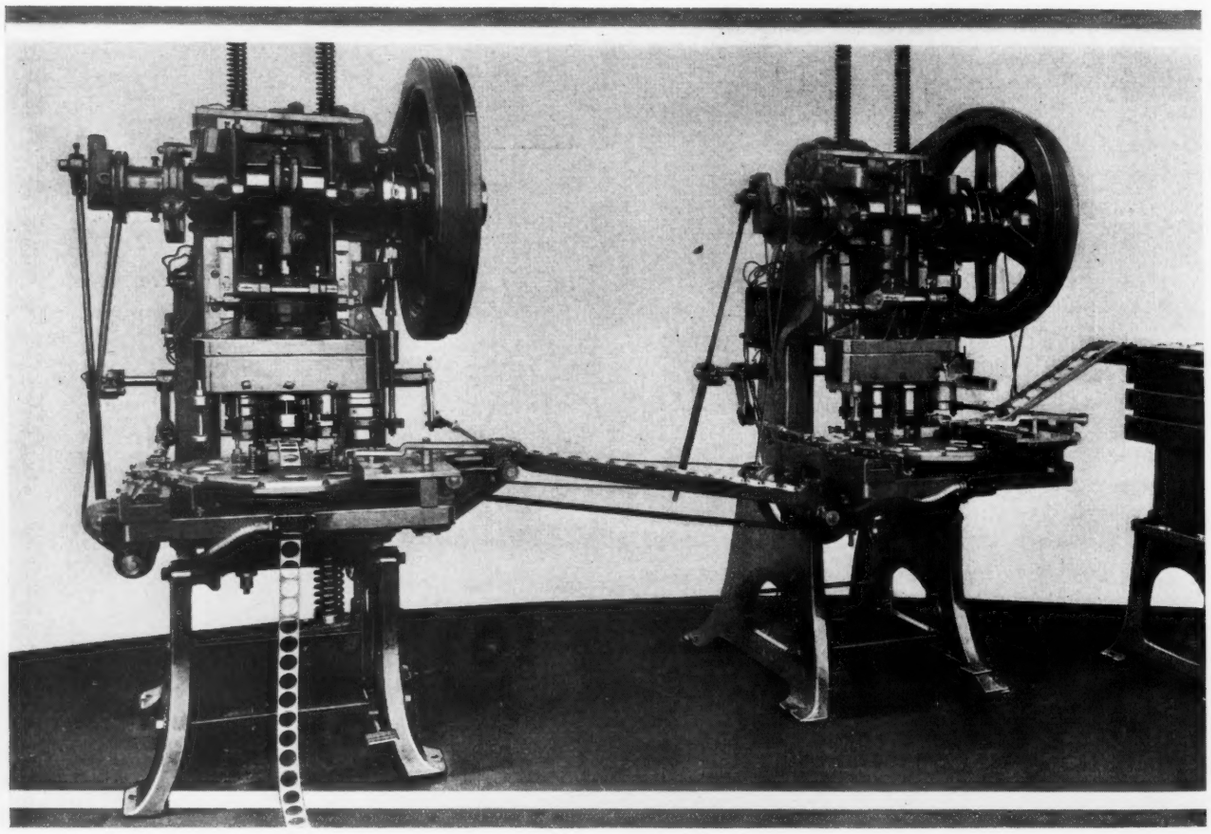


Fig. 2. Two V&O Presses Equipped as Shown Produce Can Tops with Inserted-parchment Disks at the Rate of 90 a Minute

Press for Drawing Large Stainless Steel Shells

Stainless steel shells 24 inches in diameter by 24 inches deep are drawn from 1/8-inch blanks in the large press shown in Fig. 6. This press weighs

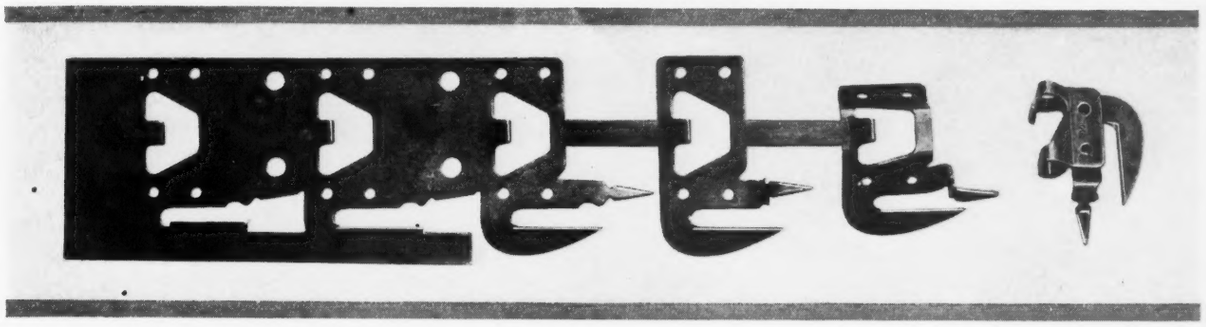


Fig. 3. Method of Producing Can-opener Blade by a Six-stage Die on the Machine Shown in Fig. 4

450,000 pounds, is about 35 feet high, and is driven by a 200-horsepower motor through triple gearing having a ratio of 80 to 1, which gives the slide 3 7/8 strokes per minute. The distance between the uprights is 69 inches. The maximum distance from the top of the bed to the bottom of the plunger slide, or die space, is 80 inches.

The use of hydraulic means for forming and shaping pressed shells has been greatly extended, and at the present time many parts are being made by a combination of regular press methods and the use of hydraulic pressure to obtain forms that ordinarily would be considered impossible to produce. One example is the tone arm for phonographs.

High-Speed Presses for Small Parts

Multi-slide piercing, blanking, and forming machines are capable of exceptionally high production. Small brass pieces are pierced, blanked, and formed at the rate of 125 to 300 a minute. Strip stock fed automatically into a machine of this type is transformed into a fast stream of pierced and formed parts as if by magic. Straight as well as coiled strips of brass, steel, phosphor-bronze, and other metals can be turned into finished parts at exceptionally high production rates, with a comparatively small expenditure for tool equipment.

A high-speed press that was designed especially for notching electric motor laminations, but is also applicable to other work, such as circular saws and bearing separators, has been developed. Tolerances of 0.002 inch can be held on this work at operating speeds of 450 to 600 strokes per minute. Disks having outside diameters ranging from 3 1/2 to 18 inches can be handled with an external notching attachment. The minimum number of notches that can be cut is 12, and the maximum 96. The internal or stator attachment handles disks from 4 to 15 1/2 inches in diameter, and in this case also, the minimum number of notches is 12, but the maximum number is 132.

Coining Presses Eliminate Machining Operations

The so-called "coining process" eliminates the need of further machining operations in many instances, and has been referred to as "machining to size by pressure." The process is not new, but the extreme pressures required for this work have heretofore confined the operation to comparatively slow-operating machines. Now, however, there are available machines that combine high pressures with a high operating speed. In addition to the high speed, the accuracy obtained is comparable to that secured by ordinary machining methods. Such presses are made in eight sizes, ranging from 20,000 to 370,000 pounds in weight.

A new principle applied to trimming dies makes it possible to trim the surplus stock

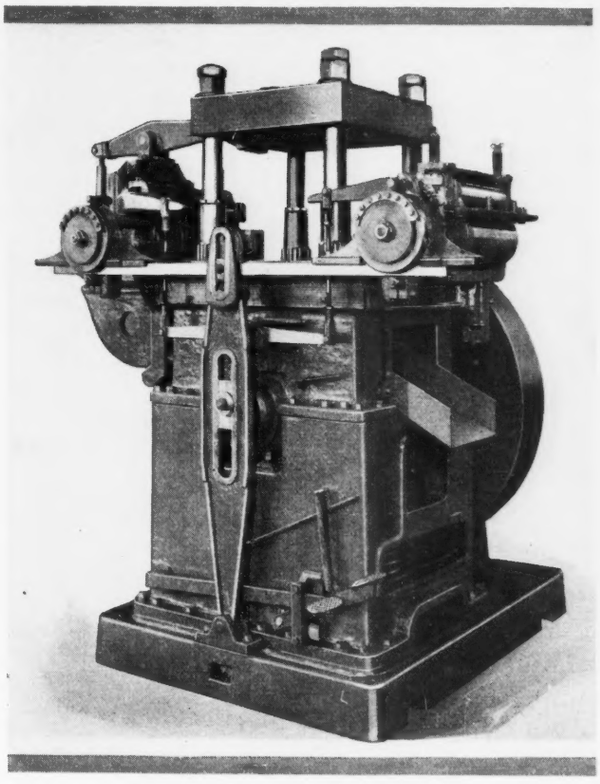


Fig. 4. Henry & Wright 50-ton Dieing Machine in which Can-opener Blade Shown in Fig. 3 is Produced

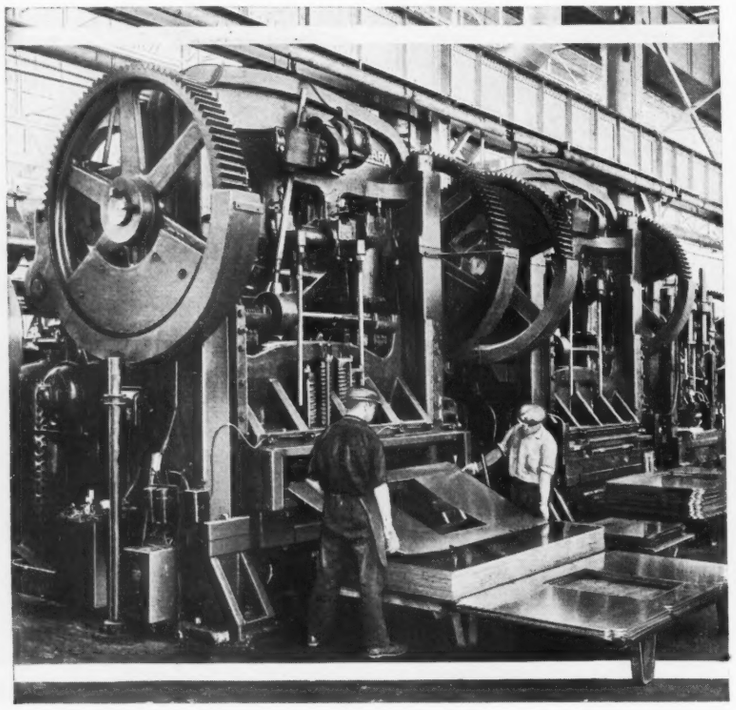


Fig. 5. Battery of Niagara Double-crank Power Presses Used by General Electric Co. in the Manufacture of Refrigerator Boxes

from steel shells with great rapidity. The trimming dies are so constructed that at a single stroke of the power press, the trimming member is oscillated in several directions so as to trim the part completely.

With this equipment, 25 shells, 4 inches square and 1 1/2 inches high, made from 0.078-inch steel sheets, are trimmed each minute along all four edges in a single operation in an arch-type power press. This machine operates continuously and is equipped with a five-station dial feed which carries the shells automatically into position beneath the ram and to the ejecting point. The trimming die, attached to the ram, oscillates in four directions in a horizontal plane during the downward stroke, shearing off all excess stock in one cut of the ram.

Forming and notching operations, such as are required in the production of sheet-metal parts for gas stoves, are being performed very rapidly on press brakes equipped with progressive dies, as shown in Fig. 7. In producing the part shown in this illustration, the corners of the sheet are notched on the first die at the left-hand end of the machine. The dies to the right are then used progressively to form the four sides. An operator can be stationed at each pair of dies and the pieces passed from one to the other, or an operator can step from one die to the other. When the latter plan is followed, the operator completes one piece without laying down the work and at one set-up of the die, thus saving considerable time. Another advantage is the simplicity and low cost of the tool equipment.

Giant Steam Drop-Hammer

In connection with the description of large power presses, it may not be out of place to refer to the developments that have been made in steam drop-

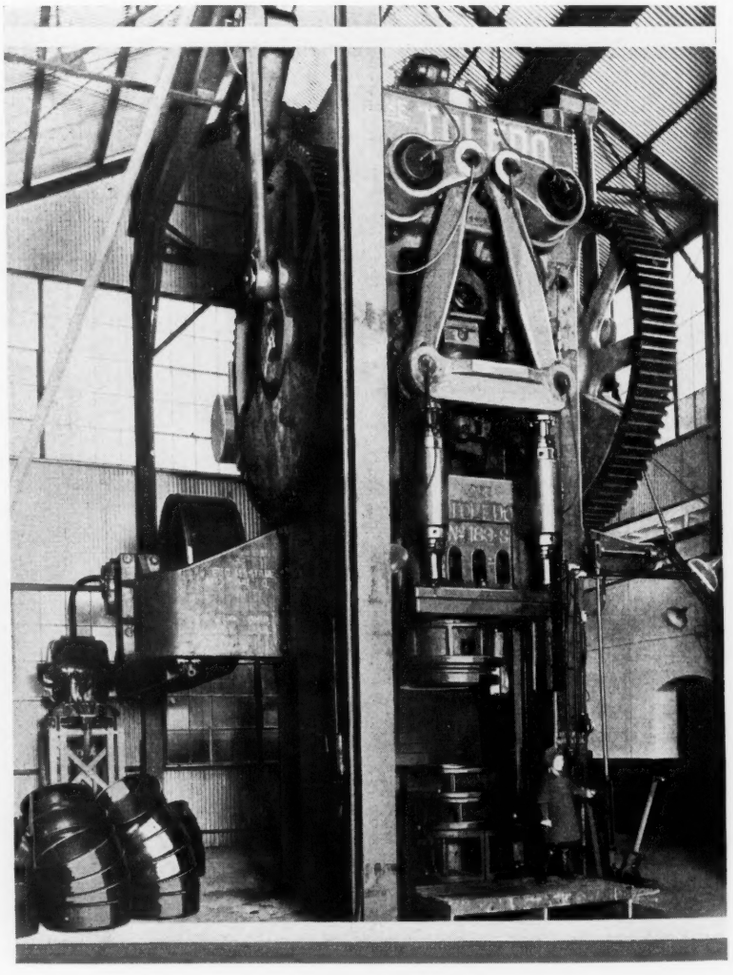


Fig. 6. Producing Stainless Steel Shells 24 Inches in Diameter by 24 Inches Deep from 1/8-inch Blanks on a 450,000-pound Toledo Press

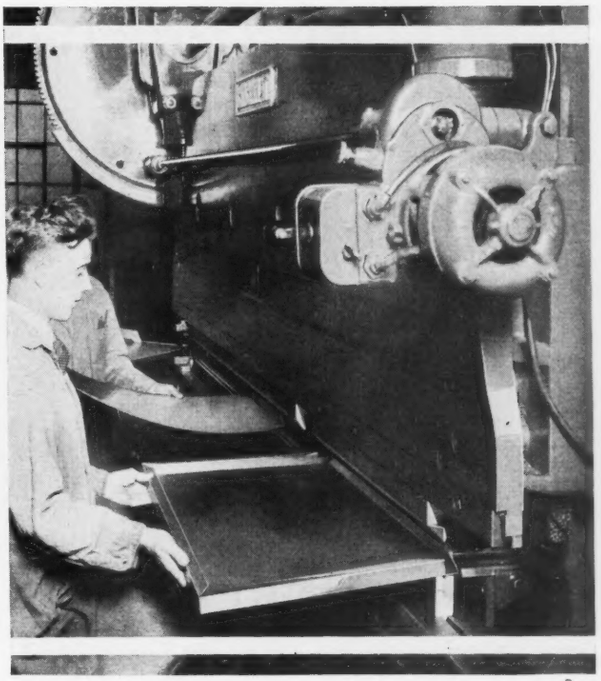


Fig. 7. Notching and Forming Sheet-metal Parts for Gas Stoves on a Cincinnati Brake Equipped with Progressive Dies

hammers. These machines are now being built in enormous sizes. One of the largest of these, if not the largest, has been built for the Henry Vogt Machine Co., Louisville, Ky. Fig. 8 shows this hammer in operation in the plant referred to.

This hammer is rated at 25,000 pounds, but the actual weight of the ram, rod, and piston is not less than 27,000 pounds. The total height of the machine is 35 feet 6 inches. This giant hammer has a 32-inch cylinder and a piston-rod 11 inches in diameter. The enormous anvil block weighs 250 tons. The sow-block measures 60 inches from front to back; the die space in the clear between the guides is 52 inches; and the ram measures 54 inches from front to back.

This hammer has produced one of the largest die forgings ever made—an 8-inch flanged gate valve which was forged from a billet weighing 2000 pounds. The finished forging weighed 1750 pounds and had an over-all length of 31 1/2 inches and a height of 24 inches. The diameter of the flange of the gate valve was 18 1/2 inches.

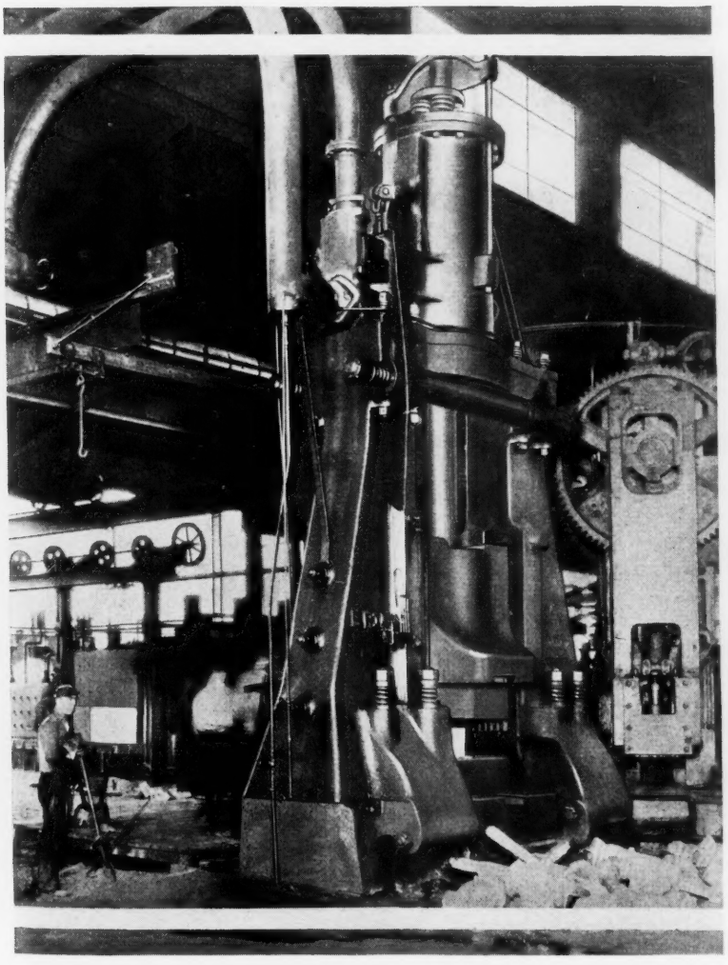


Fig. 8. Erie Foundry Co.'s Steam Drop-hammer of Huge Proportions, with a Capacity for Forging Flanged Gate Valves Weighing 1750 Pounds

Diemaker's Art Has Made Great Strides

Along with the development in power presses, there has also been corresponding progress in the methods of making dies. Thousands of objects that were formerly either cast or machined from solid stock, are made today in presses. To make it possible to produce many of these intricate shapes in a power press has taxed the ingenuity of the die designer to an exceptional extent.

This development has been made possible by improvements in many different directions. The ingenuity of the die designer would have availed little had it not been augmented by the skill of the diemaker and by the ability of the steel producer to make die steels for the construction of intricate dies, capable of being hardened without distortion. Thus, the teamwork of press manufacturer, die designer, diemaker, and steel producer has made possible one of the greatest advances in the mechanical arts.

Some of the Results Achieved by Automatic Polishing Methods

Equipping for the New Needs of Industry
Section 10

IN few lines of machine equipment has such remarkable advance been made as in the development of automatic machinery for polishing and buffing. Where but yesterday the well-known polishing stand was used for practically all polishing and buffing operations, today elaborate automatic machines are available that make it possible to finish complicated parts with a rapidity unheard of only a few years ago. For example, a machine designed for polishing and buffing the top and inside edge of a hinged automobile ventilator door, such as is used on the hoods of automobiles, finishes these doors in one pass through the machine at a rate of 950 an hour. Machines of this type are not entirely single-purpose machines. The machine mentioned, for example, can be used for polishing any kind of work that does not require a rotating work fixture.

How completely the operation of machines of this type has been made automatic will be appreciated from the fact that each polishing head is provided with an automatic polishing composition feeder placed at the front of the machine and connected to the wheels by a flexible hose. These automatic feeders deliver composition paste to the wheels by compressed air. The centrifugal force of each wheel carries the composition to a fabric collector pad, which applies a film of composition to the face of the polishing wheel either intermittently or continuously.

Valve tappet stems are polished at the rate of from forty to fifty a minute on another type of automatic polishing machine in which about 0.0002 inch of stock is removed. This machine is entirely automatic, except that the operator has to place the parts in a work-holding turret. Piston-pins and similar parts can also be polished on a machine of this type at the same high rate of speed.

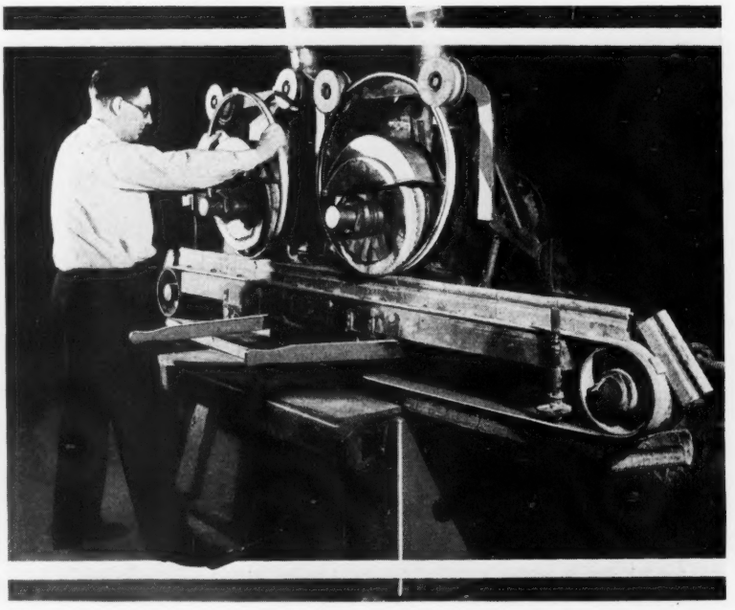
Automatic Machines Suited for Polishing a Great Variety of Shapes

Automatic polishing and buffing machines that are universal in application, because they can be employed for polishing a variety of shapes, in small or large lots, are also available. They may be of full- or semi-automatic design. The advantages claimed over hand machines are greater production per man-hour and a more uniform finish on the parts polished. Whether the work is round, flat, or beveled, the desired finish can be obtained by the use of simple work-holders. Should the work require a revolving motion about a horizontal axis, an arrangement can also be provided for this.

The production varies with the class of work, and is controlled only by the time required for the actual polishing. The machines can be operated to produce up to 2000 pieces per hour.

A "centerless-feed" polishing machine has been developed in which a high-speed wheel is used for the polishing unit and a belt device for the feeding member. This machine has been designed especially to eliminate the need of

Fig. 1. Divine Bros. Co.'s Continuous Straight-line Two-wheel Polishing Machine Turning out 700 Polished Bicycle Rims in Eight Hours



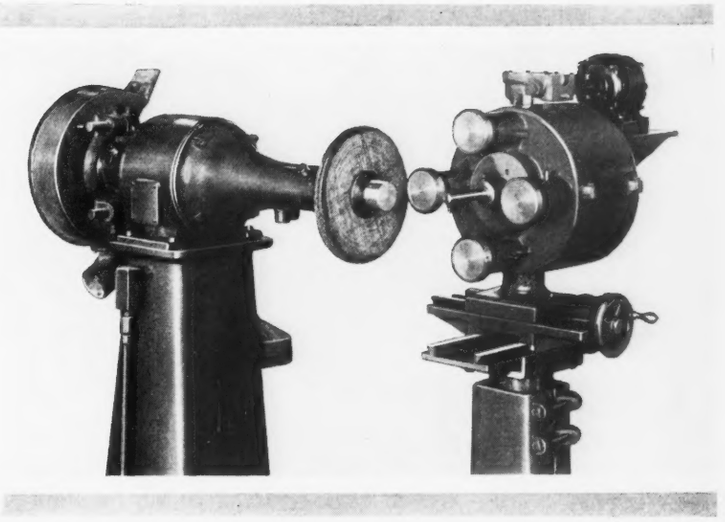
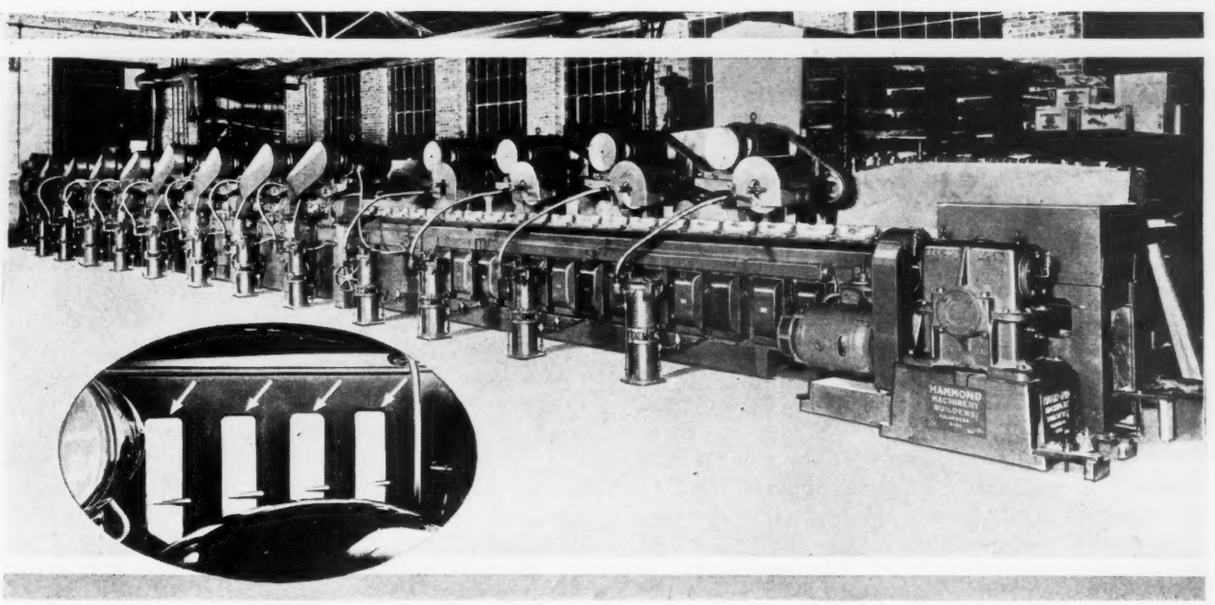


Fig. 2. (Right) Automatic Buffing Machine Co.'s Equipment Used in Buffing 500 Brass Bezel Rings, 4 Inches in Diameter, an Hour. Fig. 3. (Below) Polishing Automobile Ventilator Doors on a Hammond Automatic Polishing Machine at the Rate of 950 an Hour



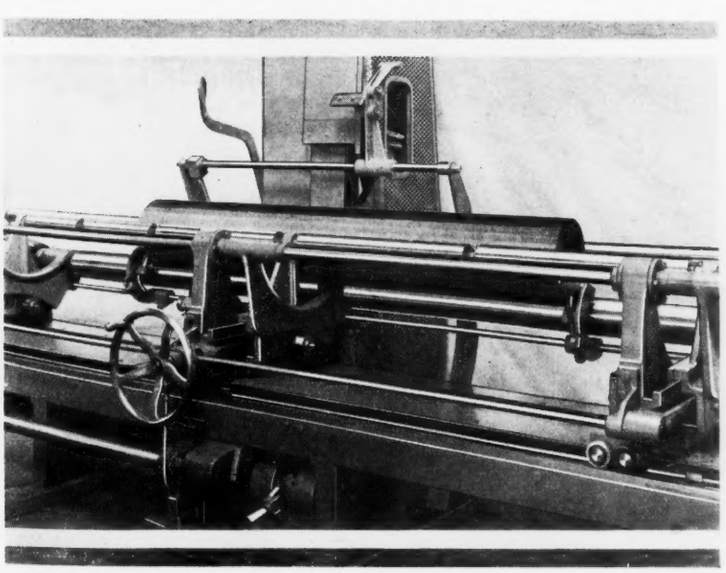


Fig. 4. (Left) Finishing Fiber Tubes, 6 to 18 Inches in Diameter and 12 to 100 Inches Long, on a Production Machine Co.'s Centerless-feed, Abrasive-belt Finishing Machine Equipped with Special Work Carriage, Built for the General Electric Co.

skilled polishing labor. Cylindrical work up to 6 inches in diameter can be polished in this manner. The machine will "cut down" from the rough and produce a fine buffed finish at a high rate of output.

Polishing Circular Work on a Straight-Line Machine

Many pieces heretofore regarded as unsuited for automatic polishing are now being handled successfully on automatic polishing machines. The flexibility and versatility of a straight-line automatic polishing machine are well illustrated by Fig. 1, which shows an installation at the plant of the Williams Steel Wheel and Rim Co., Utica, N. Y. The production on this machine is 700 completely polished bicycle rims in eight hours. The fixture holds the bicycle rim at the proper angle in relation to the polishing wheel. The work is rotated under the polishing wheel by means of a track fastened to a conveyor belt. Each polishing wheel polishes one side of a rim, the rims being transferred from one fixture to the other.

Fig. 2 shows a work-holding polishing machine set up at one end of a polishing lathe for automatically buffing brass bezel rings 4 inches in diameter, having a half-circular cross-section. The chucks open and close automatically. The indexing mechanism is set for producing 500 rings an hour.

Fig. 3 shows the automatic polishing equipment used for polishing and buffing, at one pass, the top and the inside edge of ventilator doors such as are used on the hoods of automobiles. The pieces polished are 12 inches long by 4 inches wide, and are finished at the rate of 950 pieces an hour. The machine has twelve polishing and buffing heads, each of which is a complete motor-driven unit.

New Developments in Blueprinting Practice

Automatic blueprinting machines have completely revolutionized the practice of the old-fashioned drafting-room. Industrial plants that require hundreds of blueprints daily find it advantageous to make them in machines that automatically carry the prints through the successive stages.

In these machines, the tracings are fed into the front of the machine together with sensitized blueprint paper from a continuous roll. After an exposure has been made under high-powered arc lamps, the tracings are returned to a tray in the front of the machine, while the exposed blueprint paper automatically passes through the subsequent operations of washing, potashing, rinsing, and drying. The blueprints are then automatically rolled up at the rear of the machine, ready for cutting and trimming. These automatic machines can be run at a printing speed of from 4 inches to 6 feet per minute to suit every variation and requirement of printing speed.

For small shops, a vertical blueprint machine is sufficient. Such machines, of 42- by 60-inch size, for example, will enable from 600 to 800 linear yards of paper to be printed each month. Drying machines may be provided to prevent wrinkled prints with curled edges. These dryers can be arranged to be heated either by electricity or gas.

When the quantity of prints required exceeds the capacity of the vertical equipment, it is generally advisable to install a type of machine that automatically carries the blueprints through the entire series of operations.

A new process for developing blueprints has recently been introduced. In this process, the printed paper, directly after it has been exposed, is run between two stainless steel rolls covered with what is known as "Kyano" solution. The surplus chemical is then washed from the paper as it passes through a spray-jet water wash, and the prints are ready for drying. The use of potash can be dispensed with entirely. This process gives a deep rich blue from fast-printing papers, a color that was formerly obtained only from slow-printing papers. There is a sharp line of demarcation between the blue and the white.

The new and improved equipment available has created increased interest in the economies that may be effected in producing shop blueprints. As a typical example, over 10,000 blueprints per month are averaged by only two men in the drafting department of one large machine tool plant. The economy resulting from the method used is obtained by suitable equipment arranged so that the work can be carried on without delay or lost motion. The entire blueprinting department is arranged around a 1/2-cylinder, vertical-type, blueprinting machine and a horizontal cylindrical dryer; and all auxiliary equipment is located so that there is a reasonably steady flow of prints through the department.

As an outstanding example of the savings in production costs that are made possible through the use of automatic machines in place of hand operations, the following example may be recorded. In a large well-known plant in the middle western states, a certain operation was performed on hand-operated machines. When the work was done in this manner, the parts manufactured cost from $35 to $60 per 100 pieces. The introduction of automatic machines reduced the cost to $3 to $3.25 per 100 pieces. The total cost of the automatic equipment was $78,000. It saved, in the first year, $140,000!

Gear-Cutting Machines of Recent Design Have Speeded up Production

Equipping for the New Needs of Industry
Section 11

PRACTICALLY all the builders of gear-cutting machines have been very active in developing new or improved machines incorporating means for cutting gears more efficiently, more accurately, or both. Among the improvements common to many types are the solid supports provided for both work and cutter and the positive stops introduced in the design of many models, assuring that the machine will stop at the proper place when the work is completed. The increased productive capacity of gear-cutting machines of various types is said by a large user of these machines to be at least 50 per cent greater in the latest machines, as compared with previous designs.

Gear-cutting speeds have been greatly increased, both in machines for cutting spur, helical, and herringbone gears, and in those intended for straight and spiral-bevel gears. Machines for cutting very large gears of all types have been developed. Obviously, the largest machines are for the spur, helical, or herringbone types, as these gears are regularly made in larger sizes than bevel gears. One recently built machine for cutting gears of the former types has a capacity for work 22 feet in diameter, with a 5-foot width of face, and 6-inch circular pitch.

Hydraulic features have been introduced in some gear-cutting machines. For example, an automatic machine for rough-cutting spiral-bevel gears is available in which all movements are controlled hydraulically. The time required for roughing gears has been reduced 60 per cent as compared with that taken when using equipment previously available.

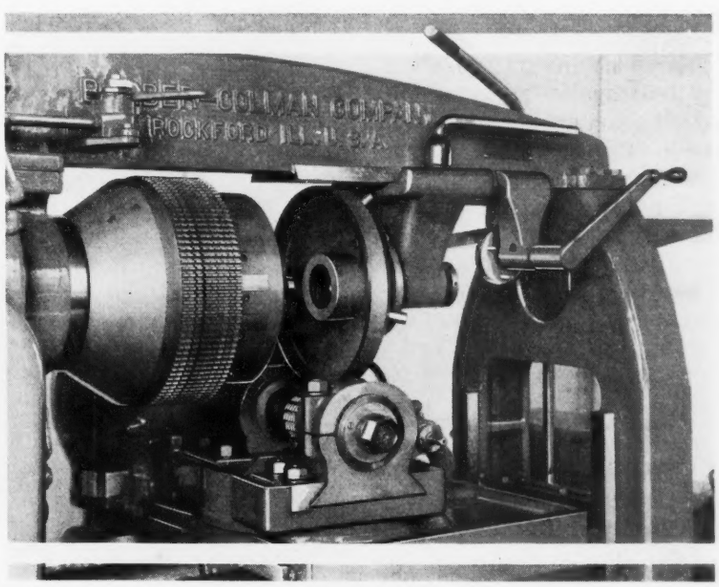
On spiral-bevel gear generators, the reversing and indexing movements are equipped with hydraulic dampeners, which insure quiet and smooth operation at high speeds. The increasing use of anti-friction bearings on these machines is also in evidence.

Gear Burnishing and Grinding Machines

Several new types of gear burnishing and grinding machines have been developed, a few examples of which may be mentioned. One gear burnisher is operated hydraulically, and is intended for cases where gears of great uniformity are required. The machine is completely automatic; all that the operator has to do is to load the work, move the control lever to turn on the hydraulic pressure, and press a single push-button. The standard type of machine has a capacity up to 14 inches outside diameter, but this capacity can be increased to 25 inches if desired.

Three master gears are revolved in engagement with the pinion being burnished in a bevel pinion burnishing machine recently developed for burnishing all types of bevel pinions. One of the master gears is belt-driven from a countershaft and can be rotated in both directions. The other two master gears are mounted on spindles that have no

Fig. 1. Ring-type Gears Cut in One Operation on a Barber-Colman Hobbing Machine in 1 1/4 Minutes, Floor-to-floor Time



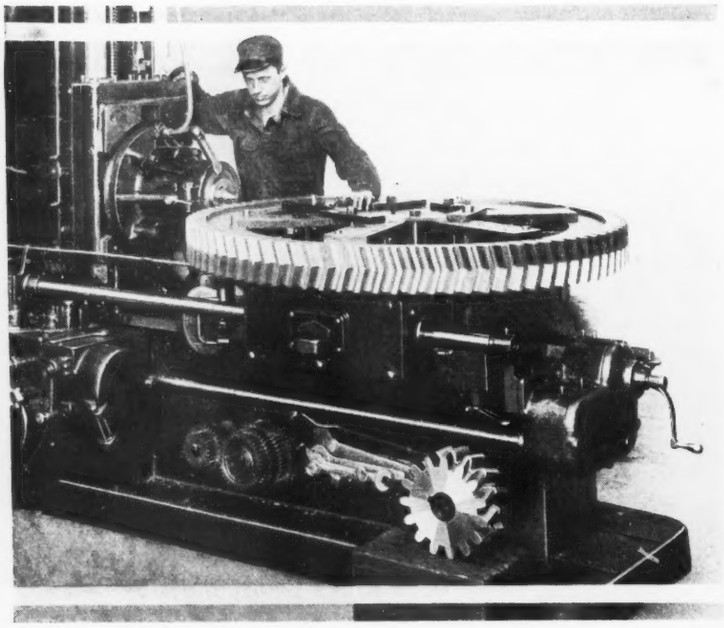


Fig. 2. Special Herringbone Gears are Cut as Readily as Standard Gears on a Newark Gear-hobbing Machine Equipped with Inexpensive End-mills

power drive. They are adjustably mounted, so that a uniform tooth pressure can be imparted to all three master gears and to the pinion being burnished. The result is a kind of swaging effect which tends to produce a hard glazed surface on the tooth profiles of the pinion.

Improvements in gear grinding are said to make it possible to bring the cost of ground gears down so low that the advantages of precision grinding are within the reach of every gear user. One of the newer types of machines is hydraulically operated and is arranged so that the adjacent sides of two gear teeth can be ground at the same time.

Selected Examples of Gear-Cutting Practice

Starter gears of the ring type, such as are pressed on automobile flywheels, are being cut in one operation on a hobbing machine equipped as shown in Fig. 1 in 1 1/4 minutes, floor-to-floor time. The best time previously obtained with older machines was 3.16 minutes. The special arbor for holding the work has parallel bars which are expanded and contracted uniformly by a hydraulically operated wedge-shaped cam inside the drum. In operation, the spindle carrying the cam is hydraulically extended into a bayonet fitting that locks into the clamping plate. When the parallel bars are expanded, the clamping plate is drawn up so that the work is clamped firmly, both on the inside and the ends. Releasing the oil pressure contracts the bars and pushes back the clamping plate, so that the finished ring gears can be easily removed.

An interesting application of a gear-hobbing machine is shown in Fig. 2. The herringbone gears shown have a normal diametral pitch of 1.63, and a tooth angle of 15 degrees 26 minutes. The only tooling required for this job was a pair of end-mills. The special tooth angle was taken care of by the standard lead change-gear. The cutting time compared favorably with that required for cutting single helical gears of corresponding sizes.

This machine and attachment have also proved very profitable in cutting large-pitch sprockets in cases where the ordinary type of milling cutter would be very expensive. Large-pitch worms that are too large to be handled on the ordinary thread-milling machine can also be handled to advantage.

Output of Spiral-Bevel Gears Increased by New Roughing and Generating Machines

The production rate in rough-cutting spiral-bevel gears has been increased as much as 290 per cent by the introduction of the machine shown in Fig. 4, while the production rate in finishing the same gears has been increased 142 per cent by another new generator. With the old-style roughing machine, for example, the production on 34-tooth, 2.70 diametral pitch spiral-bevel gears, with 1.625-inch faces, was 28 per machine in an eight-hour day and 140 per operator, whereas the new machine roughs

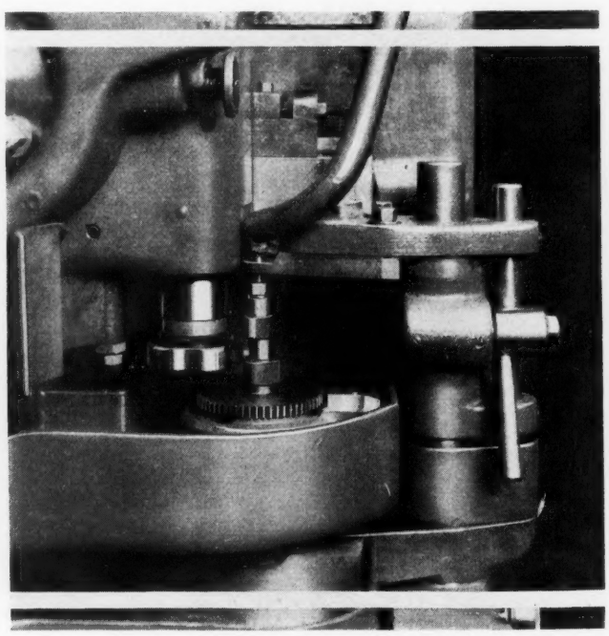


Fig. 3. Cutting Two Cams Integral with the Shaft and Gear of a Portable Gas Engine Part in Two Settings of the Work on a Fellows Gear Shaper. One Cutter is Used for Shaping Both Cams

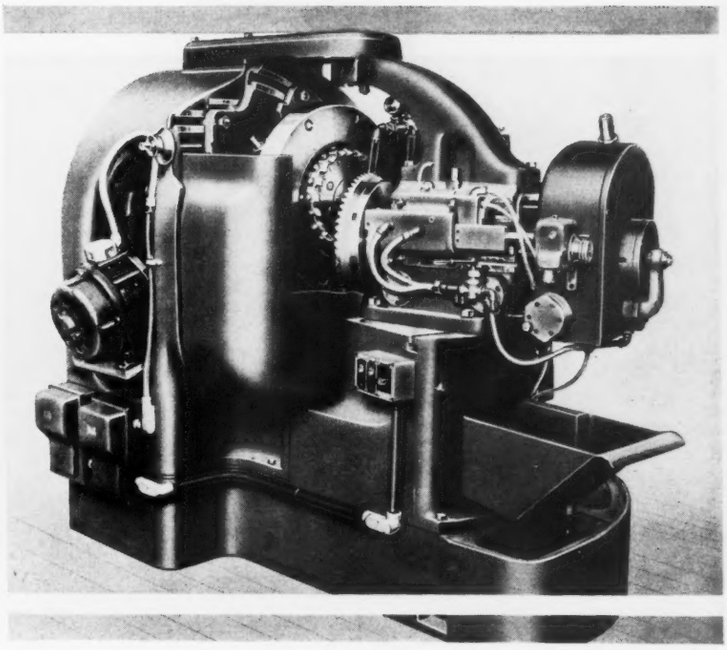


Fig. 4. Gleason Spiral-bevel Gear Roughing Machine that has Increased Production from 200 to 300 Per Cent

110 of these gears per day, or 550 per operator. The same gears were finished on an old machine at the rate of 19 per machine, or 95 per operator, whereas the production with the new spiral-bevel gear generator is 46 per machine, or 230 per operator.

Herringbone gears from 2 to 61 inches in diameter and up to 18 inches face width can be cut on the machine shown in Fig. 5. The 2 1/2 diametral pitch, 136-tooth gear shown in this particular set-up has a face width of 10 inches. The material is cast steel containing 0.3 per cent carbon and 0.7 per cent manganese. The cutting time is 7 hours.

A recently built gear generator primarily designed for cutting herringbone gears used in the steel industry has a capacity for cutting gears up to 22 feet in diameter with 5 feet face width and 6 inches circular pitch. This machine weighs 120 tons and is capable of handling gears weighing up to 50 tons.

Cutting Helical Cluster Gears for Synchro-Mesh Transmissions

Synchro-mesh transmission gears are finish-hobbed in one cut on machines equipped as shown in Fig. 6 at the plant of the Muncie Products Co. The particular operation illustrated consists of finish-hobbing a 27-tooth helical gear in 8 minutes. The material is S A E 5150 steel. Accuracy of the tooth contour is maintained within limits of 0.0003 to 0.0005 inch. Three thousand gears are cut per hob, the position of the hob being changed after cutting a certain number of gears in order to permit a maximum number of grinds.

A New Type of Machine for Finishing Gear Teeth

A recently developed machine for finishing the teeth of gears that have been rough-cut in a previous operation, involving principles of design quite different from those formerly used, is shown in Fig. 8. The finishing cuts are taken by a series of serrated blades arranged like a rack on a reciprocating table.

As an example of the performance of this machine, the following data are recorded: In finishing 28-tooth 10-pitch helical gears having a 40-degree helix angle and a 3/4-inch face, removing from 0.004 to 0.008 inch of stock on the tooth thickness, the production averages 60 gears an hour. The life of the cutter rack for gears of this size is estimated at 5000 gears per grind. The rack can be reground from twenty to twenty-five times.

A thread-generating machine particularly adapted for cutting the so-called "hourglass type" of worms that are used extensively in automotive steering gears presents an especially rapid means of cutting worms. As an example, a single-thread "hourglass" worm of 4.268 inches diametral pitch can be completed in 2 minutes floor-to-floor time. The actual

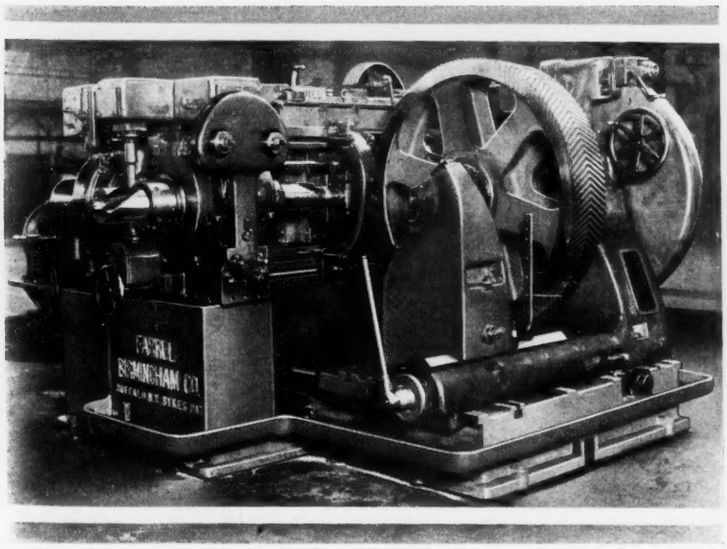


Fig. 5. Farrel-Birmingham Co. Sykes Gear-cutting Machine with New Roller Rim Support Cutting a 136-tooth, 2 1/2 Diametral Pitch Gear in 7 Hours

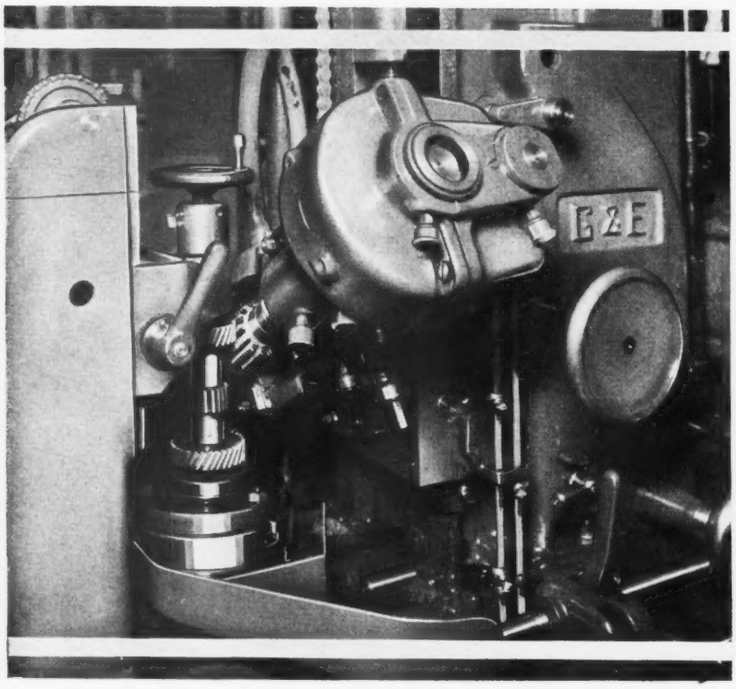


Fig. 6. One of a Battery of 35 Gould & Eberhardt Gear Hobbers Used in Cutting Synchro-mesh Transmission Gears. The 27-tooth Gear Shown is Finish-hobbed in 8 Minutes

cutting time is 45 seconds for roughing, and the same for finishing.

In producing automobile drive shafts and rear axle shafts, multiple splines must often be cut on the end of a shaft on which no other machining operations are performed, except the centering of both ends and the turning of that portion on which the splining is done. In other cases, driving must be done on the tapered end of a shaft. These conditions preclude holding the shaft in a collet type chuck and necessitate supporting it between centers, utilizing a driving element that will compensate for any inequalities in the rough surface.

For work of this kind the hobbing machine shown in Fig. 9 gives good results. The hobbing of the six splines on the gear end of the automobile rear axle shaft shown has been accomplished with a closer degree of accuracy than by any of the methods previously employed. The body of the chuck fits the threaded spindle nose. The sliding jaws fit into T-shaped slots in the chuck body. The jaws are opened and closed by the conventional screw with right- and left-hand threads. The portion of the screw between the right- and left-hand threads is a V-section and contacts with a pin of the same shape having a spring tension that tends to keep the screw in a central position.

Auxiliary jaws are fastened to the sliding jaws, being free to move in a short arc to conform with stock inequalities. The gripping surface is formed back on a radius, so that there is a four-point gripping contact on straight work, or on work having a slight taper. When chucking out-of-round stock, the jaws are actuated against the spring tension of the pin, and the auxiliary jaws equalize themselves, giving an equal gripping pressure on the surface of the shaft held between centers.

Chamfering Teeth of Bevel Gears

The teeth of automobile bevel gear pinions having as few as five teeth are chamfered on the front and back in one operation on the machine shown in Fig. 10. The two tools used on this machine operate simultaneously, chamfering the front and back of the tooth in four seconds. Gears up to 18 inches in diameter and having any number of teeth can be handled on this machine. Operation of the machine is by a self-contained hydraulic unit or by attachment to the air system.

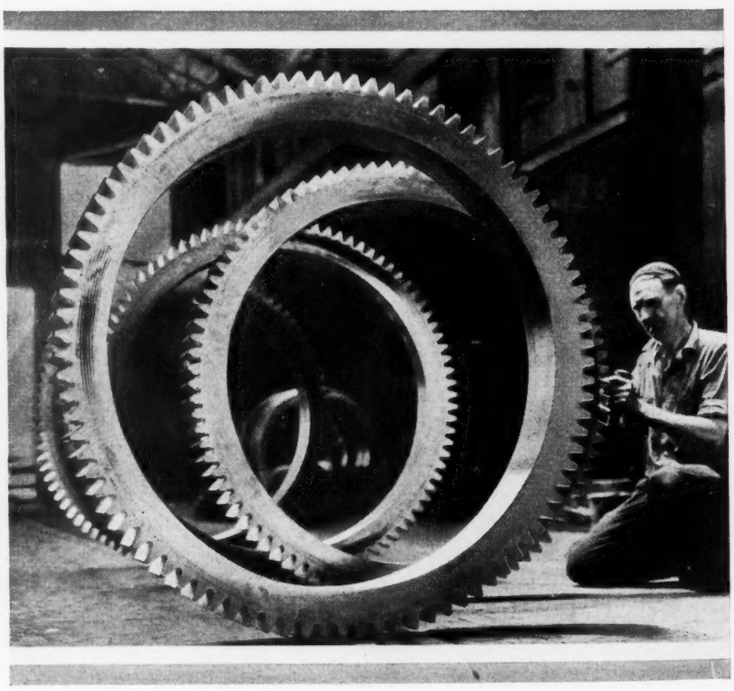


Fig. 7. These Ring Gears Made at the Nuttall Works of the Westinghouse Electric & Mfg. Co. for Fifty-four New Pennsylvania Passenger Locomotives are Probably the Most Accurate Gears of this Kind Ever Made. The Tooth Spacing is Held Within 0.001 Inch

MACHINERY'S DATA SHEETS 237 and 238

APPLICATIONS AND COMPOSITIONS OF BABBITT METALS FOR BEARINGS
S A E STANDARD SPECIFICATIONS

Specification Number	Application	Composition, in Percentages*			
		Tin	Copper	Antimony	Lead, Maximum
10	Owing to its fluidity, this babbitt is used for bronze-backed bearings, particularly those having thin linings. It is also suitable for die-castings.	90.00 90.75	4.00 to 5.00 4.25 to 4.75	4.00 to 5.00 4.25 to 4.75	0.35† 0.35†
11	Fairly hard. Used for lining connecting-rod and shaft bearings subject to high pressure; has slight tendency to "wipe"; can be die-cast.	86.00 87.25	5.00 to 6.50 5.50 to 6.00	6.00 to 7.50 6.50 to 7.00	0.35† 0.35†
12	A relatively low-cost babbitt, intended for bearings subjected to moderate pressures. Also suitable for die-castings.	59.50 Min. 60.00 Min.	2.25 to 3.75 2.75 to 3.25	9.50 to 11.50 10.25 to 10.75	26.00 25.25
13	Low-cost babbitt, adapted to large bearings for light service. Should not be substituted for high-tin babbitt. Also suitable for die-castings.	4.50 to 5.50 4.75 to 5.25	0.50 Max. 0.50 Max.	9.25 to 10.75 9.75 to 10.25	86.00 85.50
14	Low-cost babbitt, adapted to large bearings for light service. Should not be substituted for high-tin babbitt. Also suitable for die-castings.	9.25 to 10.75 9.75 to 10.25	0.50 0.50	14.00 to 16.00 14.75 to 15.25	76.00 75.25

*Upper values are for cast parts and lower values are for alloys in ingot form. The limits for the chemical compositions specified for alloys in ingot form are closer than the limits specified for cast parts, as allowances have been made for variations in the chemical content due to casting.

Alloys Nos. 10, 11, and 12 contain 0.08 per cent (maximum) bismuth and 0.08 per cent (maximum) iron. Alloys Nos. 10 and 11 contain 0.10 per cent (maximum) arsenic, and alloys Nos. 13 and 14 contain 0.20 per cent arsenic. For the alloys mentioned, the percentages are the same for both the cast and the ingot form.

†When finished bronze-backed bearings are purchased, a maximum of 0.6 per cent lead is permissible in scraped samples, provided a lead-tin solder has been used in bonding the bronze and the babbitt.

MACHINERY'S Data Sheet No. 237, New Series, November, 1932

S A E SPECIFICATIONS FOR SHEET DURALUMIN (ALLOY NO. 26)*

Physical Properties After Heat-treatment†

Sheet Thickness, Inches	Minimum Tensile Strength, Pounds per Square Inch	Minimum Yield Point, Pounds per Square Inch	Minimum Elongation in 2 Inches, Per Cent
0.010 to 0.020	55,000	30,000	15
0.021 to 0.128	55,000	30,000	18‡
0.129 to 0.258	55,000	30,000	15
0.259 to 0.500	55,000	30,000	12
0.501 to 1.750	55,000	30,000	9

Thickness Tolerances¶

Thickness, Inches	Tolerances, Inches		
	For Widths 18 Inches and Less	For Widths 18 Inches to 36 Inches	For Widths Over 36 Inches
0.013 to 0.036	0.0015 Plus or Minus	0.0020 Plus or Minus	0.0025 Plus or Minus
0.037 to 0.050	0.0020 Plus or Minus	0.0025 Plus or Minus	0.0030 Plus or Minus
0.051 to 0.070	0.0025 Plus or Minus	0.0030 Plus or Minus	0.0040 Plus or Minus
0.071 to 0.090	0.0030 Plus or Minus	0.0030 Plus or Minus	0.0040 Plus or Minus
0.092 and Heavier	5 Per Cent × Normal Thickness	5 Per Cent × Normal Thickness	.....

*This alloy is commonly designated as "Dural" or "17S." It is also used in the wrought condition, either rolled, drawn-forged, or extruded. When used in sheet form, the physical properties and thickness tolerances should conform with the figures given in the table.

In the form of tubing and extruded shapes, the same tensile strength and yield point are obtained, the elongation varying with the cross-sectional area of the test section. Rod and bar will also show the same properties, except in certain of the larger sizes, where manufacturing limitations may result in slightly lower values.

This alloy is used extensively in the construction of motor coaches, trucks, and aircraft, both heavier and lighter than air. It is available in all the forms in which metals are commonly used—sheet, plate, strip, tubing (including streamline and other special shapes), bar, rod, wire, rivets, bolts, nuts, screws, and other screw machine products, structural shapes, and extruded sections specially designed for aircraft construction.

†In the annealed temper, the tensile strength shall not exceed 35,000 pounds per square inch.

‡Sheets 30 inches or more in width, having thicknesses of from 0.021 to 0.040 inch, may show a minimum elongation of 17 per cent.

¶These thickness tolerances are commercial for sheet duralumin.

MACHINERY'S Data Sheet No. 238, New Series, November, 1932

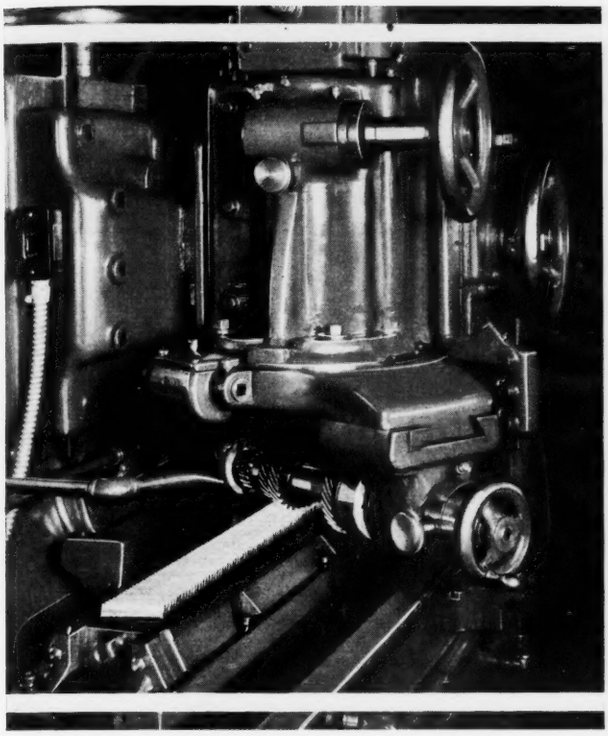


Fig. 8. (Left) Helical Gears of Packard Automobile Transmissions are Finish-machined on a Michigan Tool Co.'s Gear-finishing Machine at the Rate of 60 an Hour

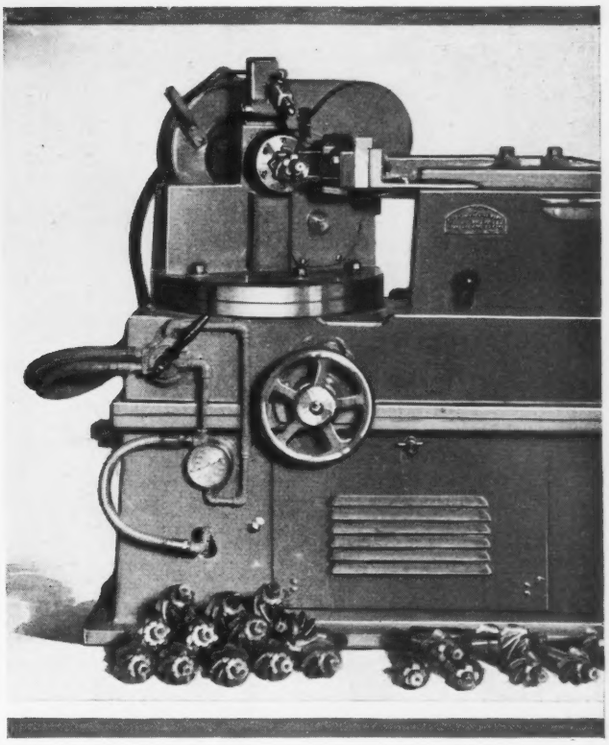


Fig. 9. (Below) Adams Manufacturing Hobber Used for Producing Six Splines on an Automobile Axle Shaft at the Plant of Edwin L. Stanton, Inc., Los Angeles, Calif.

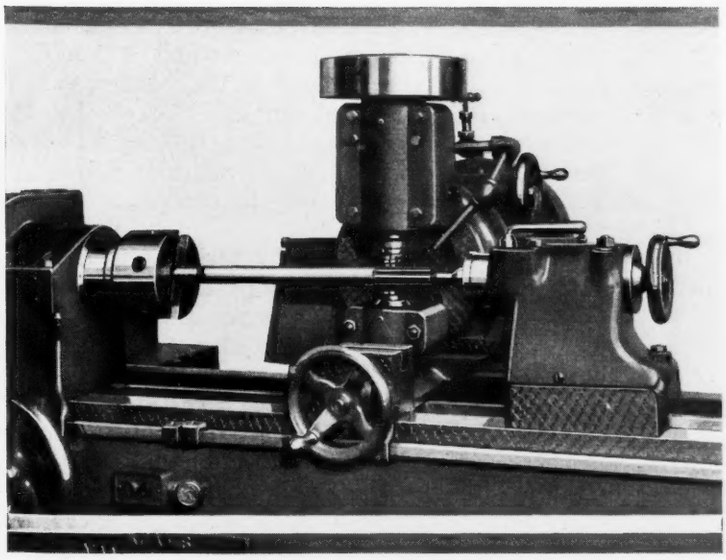


Fig. 10. (Above) Bilgram Bevel Gear Chamfering Machine Equipped for Chamfering the Front and Back of the Tooth in One Operation

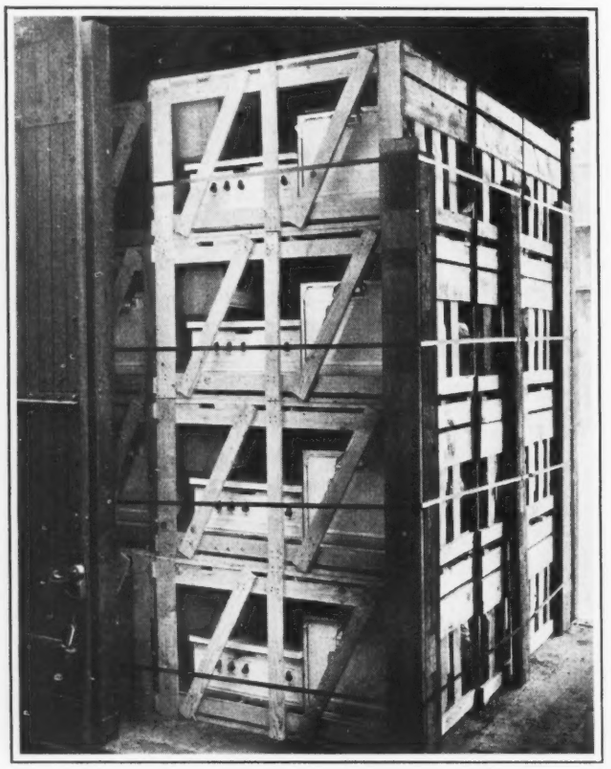


Fig. 1. A Loaded Car, Showing the Method of Banding to Eliminate Shifting of the Load on the Road

How to Crate Prevent Damage

A Knowledge of the Proper Methods of Packing and Crating is Just as Important as an Understanding of the Basic Principles of the Construction of the Machine

IN a previous article in MACHINERY (September, page 6), the author pointed out the causes of damage to shipments of heavy machinery and explained methods of preventing such damage. In this article, the protection of machinery, etc., of average size will be discussed.

The two principal types of nailed crates suitable for general shipping are the three-way corner and the box style. The box-type crate differs from the three-way corner style in that it has six additional lengthwise edge members that form supplementary skids for four sides of the crate. Otherwise, the construction is the same. The outstanding characteristic of both types is their great resistance to crushing at the corners. When either of these types is properly braced or banded, as shown in Fig. 1, they will successfully resist rough handling. They are easy to handle, easy to construct, and their effectiveness can be varied by changing the details of construction.

The Strength of the Crate Depends Mainly on Its Foundation

In both types, the edge members form the foundation or platform on which the rest of the crate is constructed. The edge members, of course, must be of sufficient size and strength to allow for adequate fastening of the remaining members of the crate. Square edge members are preferable, because they allow the use of larger nails and there is less chance of their splitting.

The base frame members, placed lengthwise, usually form the skids which support the machine either as a solid floor or by intervening members. When crates are designed to carry exceptionally heavy objects, special skids can be used to facilitate handling. Strong skids are essential because of the heavy battering to which they are subjected by rollers, dollies, etc., which would otherwise disrupt the entire crate.

Importance of Proper Bracing

Proper bracing is the most important item in crate construction. Diagonal braces on all sides of the crate will produce the maximum amount of rigidity, with the minimum amount of labor and material. When an odd number of crate faces is braced, the crate will twist if subjected to strain or if it is dropped on any of its corners.

If one or two sides are not braced and the remainder are, strain will twist the crate, although there are occasions when this method of bracing is desirable, as explained later. If the machine is fastened or blocked against any one of the sides, the crate surfaces, displaced by this twisting, will come into contact with the machine and may damage it, leaving little evidence that the crate has failed to provide protection.

If the machine is securely fastened to the skid floor or base members, diagonal braces can be omitted on one side to allow for slight distortion. The decision as to the advisability of doing this requires good judgment, however. The theory is that the crate will be subjected to a certain degree of strain and that if it is constructed with one side not braced, the allowable distortion will permit the crate to absorb a shock that would otherwise seriously damage the contents. The method of crating, of course, rests with the shipper whose decision is

Machinery to in Transit

By JOHN G. DAVIES

governed by the class of goods being shipped. The method mentioned, however, is given here because it has merit from certain standpoints and in many cases has proved more satisfactory than rigid bracing.

The use of nails calls for extreme care in the construction of crates to avoid direct pull. When the nails are freshly driven, their holding power may be sufficient, but it will decrease rapidly when the wood loses some of its moisture content. For this reason, it is well to have the bottom boards of a crate base above the lower horizontal edge members or skids. Direct pull on the nails used in the side slats can be avoided by placing the slats inside the frame members. Cement-coated nails should be used whenever possible to increase the holding power, and splitting can be practically overcome by staggering the nails.

Three-Way Corner Has Greater Strength and Reduces the Crate Size

The three-way corner construction has the advantage over other methods of having each corner member securely fastened by nails in two directions. When nails are used in this construction, they are driven into side grain, and, consequently, have greater holding power, each member bracing the other. Also, only one thickness of frame member intervenes between the machine and the outer section of the crate, thus minimizing the crate size.

Fig. 1 is an excellent example of crate construction and loading. Even this job could have been improved upon, however, if the diagonal braces opposed each other, both braces running from the corners toward the center. Fig. 2 shows this method of cross-bracing applied to a three-way corner crate. If this construction had been used in Fig. 1, each brace would have been counterbraced around the entire crate and resistance to shifting of the load would have been increased. As shown, the hazard of the load shifting has been removed by the latest method of securely banding the entire load with protective corner boards. These boards prevent the bands from cutting into the edge members and pulling them against the contents. This method is also suitable for crates of standard size.

In this way, no one crate will receive exceptional pressure. Shifting is taken up by the entire load and the bracing for doorway protection is simplified, because of the advantage of a solid and protected face against which to construct the bracing.

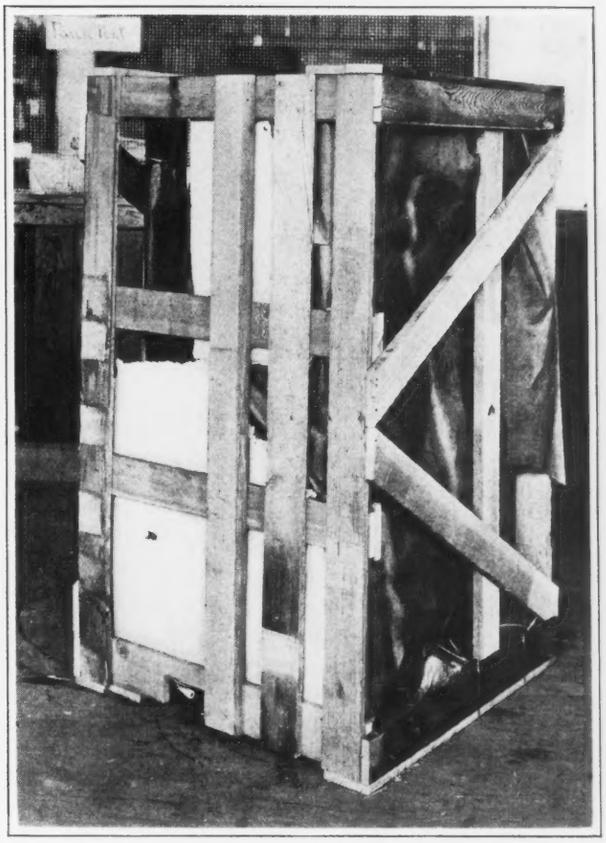


Fig. 2. Crate Constructed for Medium Weight Machines. Opposing Braces Provide Increased Strength

Following the construction of the skid base, edge members, etc., extreme care should be exercised in the placement of the sheathing. The purpose of sheathing is to protect the contents of the crate from injury by external objects and to reduce the hazard of pilferage. Sheathing should be placed diagonally to produce the best results from the standpoint of resistance. However, it should never run in the same direction as the brace.

Sheathing may be placed either inside or outside of the frame members of a crate. Unless the machine is securely blocked on the skid base and not likely to exert a strain on the sides of the crate, it is best to place the sheathing on the outside of the frame members. It is not necessary to use first-class lumber for sheathing purposes, although the skid base and edge members should be of good grade. Knots and other defects in the principal members of a crate seriously impair its strength and may cause loosening of the joints, displacement of the sheathing, and sagging of the crate.

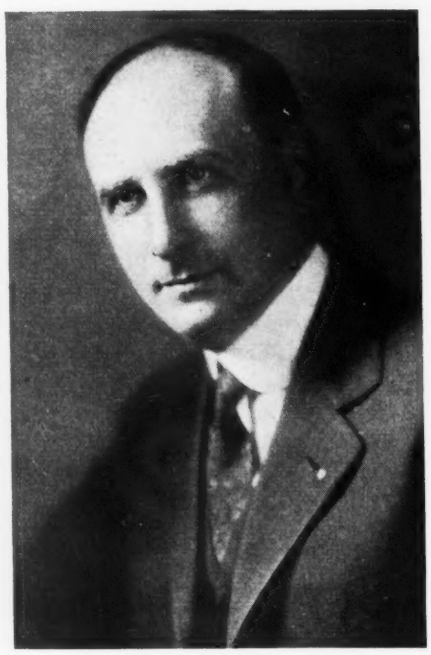
It is always an advantage in crate construction to fasten the diagonal braces to the wide face of the edge members. This reduces the danger of the nails splitting the edge members and permits the use of more nails. Another practice that will mate-

rially add to the strength of a crate is to place blocks inside the edge member at the foot of the brace. This almost doubles the resistance of the crate against diagonal pressure.

It is well to bear in mind that expert crating alone does not insure that a machine will not be damaged in transit. Additional hazard must be taken care of by interior packing, padding, etc. Such precautions will help to prevent loss and assure that shipments will be received in good condition.

American Society of Mechanical Engineers Elects A. A. Potter President

A. A. Potter, dean of the Schools of Engineering of Purdue University, Lafayette, Ind., has been elected president of the American Society of Mechanical Engineers for 1933. Dean Potter was born in Russia. Upon coming to the United States, he entered the Massachusetts Institute of Technology, graduating in 1903 with the degree of B.S. He received his doctor's degree in engineering from the Kansas State College in 1925.



Dean A. A. Potter, of Purdue University, Newly Elected President of the American Society of Mechanical Engineers

For two years after graduation he was in the employ of the General Electric Co. and then started on his career as a teacher of engineering at the Kansas State College, first as assistant professor, then in 1910 as professor, and in 1913 as dean and director of the engineering experiment station. Since 1920 he has been associated with Purdue University as dean of the schools of engineering, as well as director of the engineering experiment station and professor of power engineering.

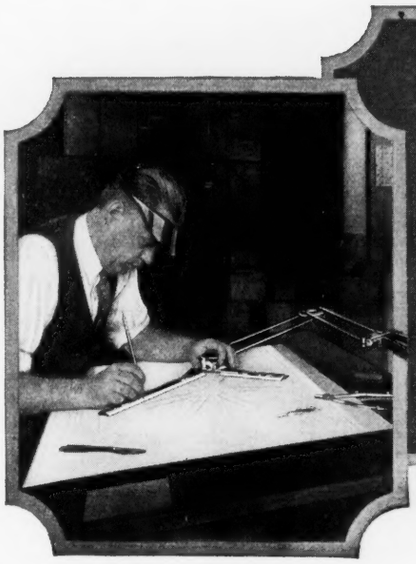
Dean Potter has also taken an active part in public and association activities. He has been consulting expert of the U. S. Department of the Interior, associate member of the U. S. Naval Consulting Board, and educational director in the War Department. He has been president of the Society for the Promotion of Engineering Education, president of the Kansas Engineering Society, president of the Indiana Engineering Society, vice-president and acting president of the Association of Land-Grant Colleges, chairman of the Engineering Section of the Association of Land-Grant Colleges and Universities, and a member of the Prime Movers Committee of the National Electric Light Association. He is the author of several books on engineering and of numerous articles on engineering and educational subjects.

Dean Potter has served on numerous committees of the American Society of Mechanical Engineers, has been chairman of the Indianapolis Section of the Society, and a representative of the Society on the American Engineering Council. As director of the engineering experiment station at Purdue, he has been in unusually close contact with the engineering problems of industry.

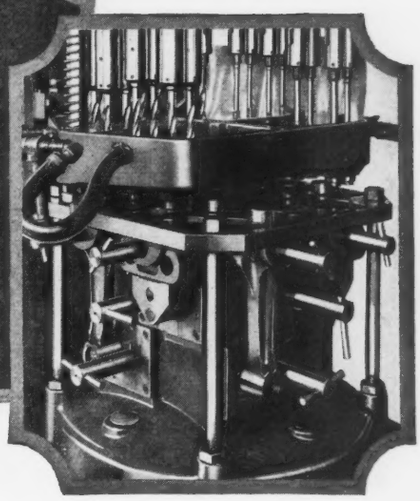
New Products Conference Held in Cleveland

The Cleveland Engineering Society staged what is known as a New Products Conference in Cleveland, Ohio, September 28 and 29. In connection with the conference, exhibits were on display relating to new developments. These exhibits were divided into three groups—new ideas of individuals; models and pictures showing the steps used in the production of various goods; and finished products.

At the conference, a number of important papers were read. Frederick M. Feiker, director of the Bureau of Foreign and Domestic Commerce, spoke on "New Products—The Way Out?"; Zay Jeffries, consulting metallurgist of the Aluminum Co. of America, dealt with the topic "A New Product Program for the Manufacturer"; and Tell Berna, general sales manager of the National Acme Co., spoke on "Production Machinery." Other papers dealt with financing and marketing of new products.



Design of Tools and Fixtures



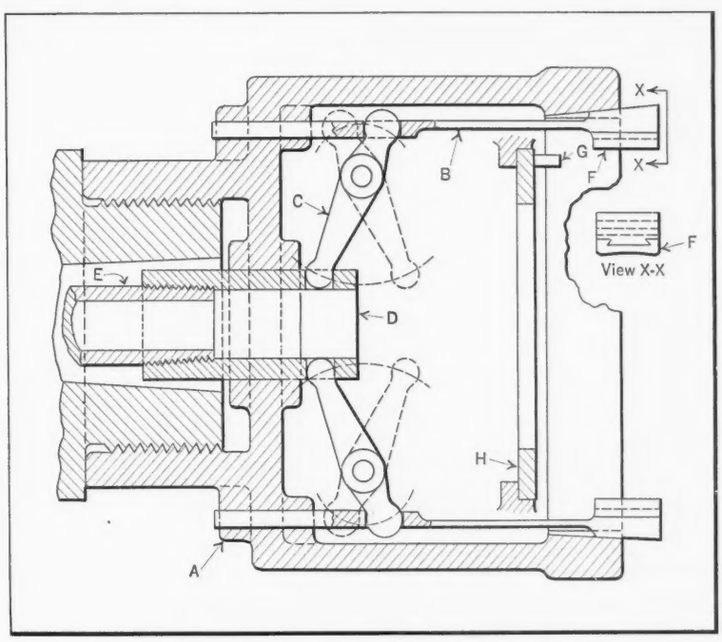
Large Draw-In Chuck with Interchangeable Jaws

By M. JACKER, Oakland, Calif.

Extreme accuracy is often required in centering work of large diameter in a lathe chuck. A chuck that meets this requirement and that can be used for general work is shown in the illustration. The pot-shaped body *A* is threaded to fit the lathe spindle. The jaws *B* are turned at one end to a slip fit in the chuck body. The other end slides in a tapered groove cut in the body.

Levers *C*, pivoted in the chuck body, engage a slot in the jaws and also an annular groove in the ring *D* which is fastened to the draw-bar *E* of the lathe spindle. Auxiliary jaws *F* are dovetailed to the jaws proper and are interchangeable for work of various diameters. Plate *H*, with its stop-pins *G*, is also interchangeable for squaring up work of different lengths.

In use, the work is placed between the auxiliary jaws *F* and against the stop-pins. Now, by forcing the draw-bar to the right, the levers *C* will move jaws *B* to the left, thus causing their right-hand ends to slide along the tapered grooves and carry the auxiliary jaws tightly against the work. Jaws *B* are made slender so that they will spring and prevent binding in the chuck body.



Draw-in Chuck for Holding Large Work of Various Diameters that Must be Centered Accurately

Attachments for Vernier Caliper

By WILLIAM C. BETZ, Master Mechanic
Fafnir Bearing Co., New Britain, Conn.

Auxiliary jaws for a vernier caliper, as shown at *A* and *B*, Fig. 1, have been found very useful. The jaws *A*, fitted to the face of the vernier caliper jaws, permit internal measurements to be read directly and eliminate wear on the jaws of the caliper. Auxiliary jaws of this kind can be refinished many times without impairing their accuracy. They are also longer than the vernier jaws, a feature that is of value in measuring over the tops of internal threads. Jaws *B* are used only as precision points in a vernier divider, eliminating the necessity of setting the spring divider to the gage centers *C* on the caliper head and slide.

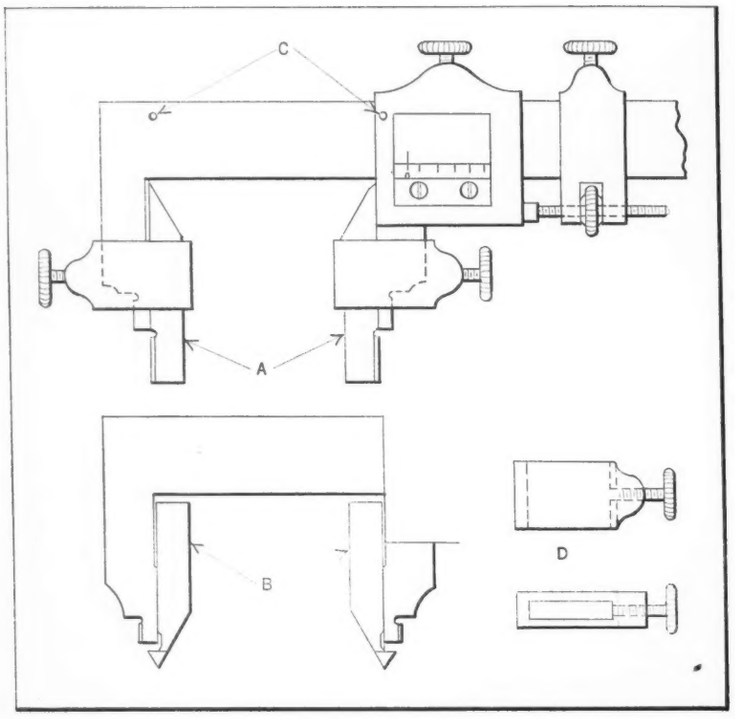


Fig. 1. Vernier Caliper Attachments

The jaws *A* and *B* are made from old pillar files, ground to the sizes required. They are ground and lapped to a true plane at *C*, Fig. 2. The angle-iron *L* is mounted on the faceplate of a small cylindrical grinder, with the surface set below the center line of the faceplate an amount *H* equal to half the thickness of pieces *A* and *B*. This setting of the faceplate provides for grinding the gage surfaces of jaw *A* to the required radius and for grinding the points on the pieces *B*.

The plug *E*, which is flattened by milling or grinding to the required dimensions, is fitted to the grinder spindle and used to locate the angle-iron *L* on the faceplate. The locating of the angle-iron is accomplished by bringing its face firmly against the flattened side of the plug. The jaw *A* is fastened to the angle-iron with the face *C* parallel with the center line of the grinder spindle.

The section of the jaw to be ground to a radius form must overhang the end of the angle-iron, as illustrated. The faceplate is carefully balanced before grinding the jaw. The radius to which the jaw is ground should be equal to the width of the jaw. The grinding operation is continued until only a faint line remains on the center of the ground surface. The jaws *B* are finished in a similar manner, the point being ground to an included angle of 60 degrees. The clamps *D*, Fig. 1, may be purchased from manufacturers of vernier calipers.

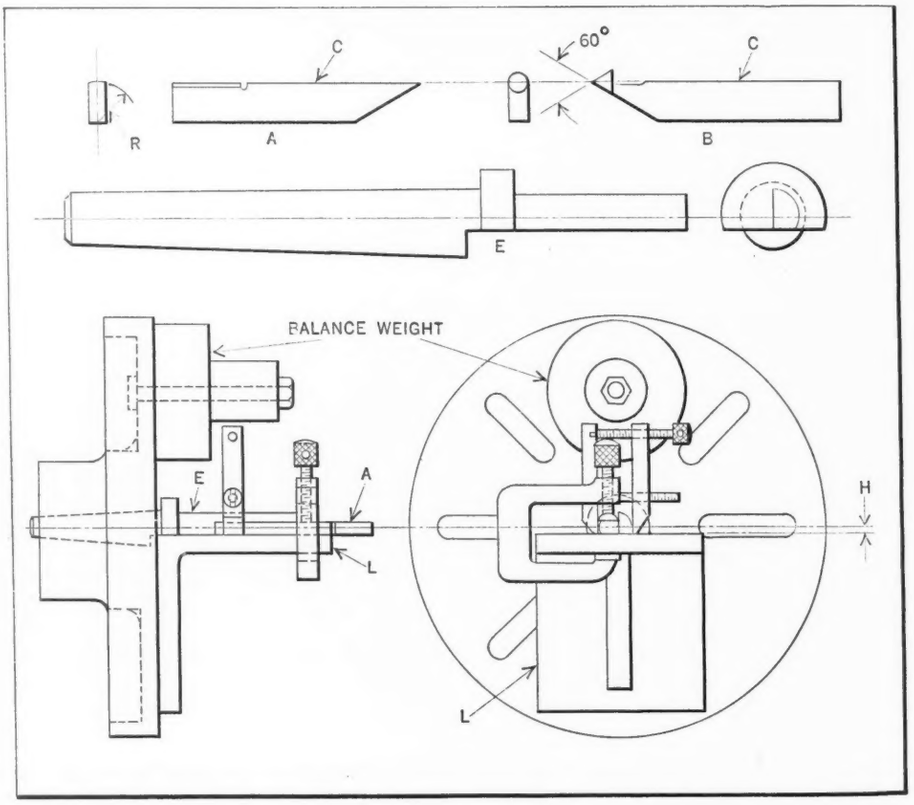


Fig. 2. Set-up Used on Cylindrical Grinder Faceplate for Grinding Pieces A and B

Forming and Folding Die for Paper Boxes

By H. R. SCHMIDT, Philadelphia, Pa.

Quantities of flat paper blanks, shaped and slit as shown at *A*, Fig. 1, are required to be formed or folded to a box shape, as illustrated at *C*. The forming is accomplished in one operation on the unique push-through die shown in Fig. 2. The cast-iron base *A* has a rectangular opening at *B* through which the punch *D* forces the formed box. Funnel-shaped grooves *M* lead into the rectangular hole at *H*. The shape of the grooves *M* at the top is not a true semicircle, but is made up of two arcs *J* and *K*, struck from the same center but with different radii, as shown more clearly in view *L*, Fig. 1.

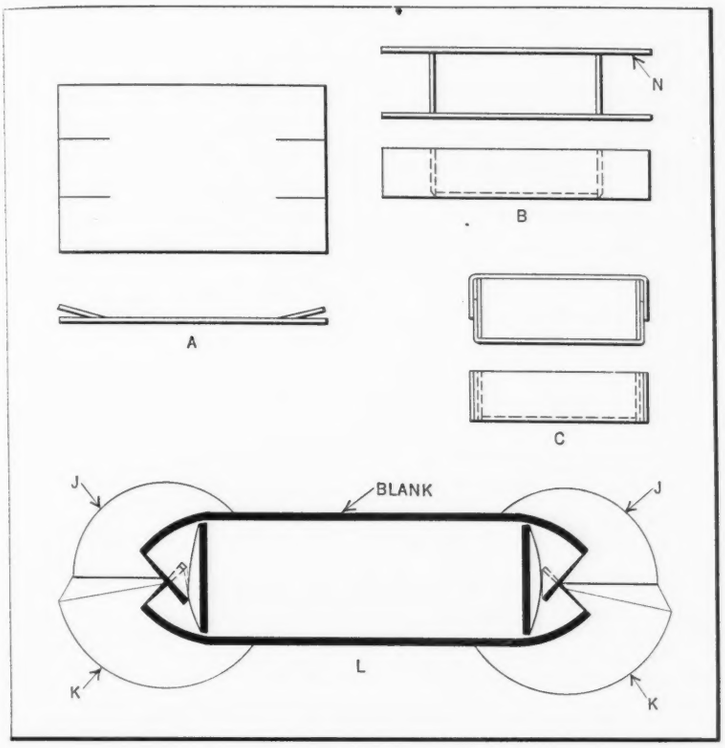


Fig. 1. Views Showing Steps in Forming Paper Box

Two tool-steel inserts *E*, Fig. 2, which are flush with the top of base *A*, are provided for forming or folding the tabs upward at the same time as the sides are being folded upward, so that the blank has the form shown at *B*, Fig. 1. The nest *F*, Fig. 2, is shaped to suit the blank.

The blank to be formed is placed in the nest, and as the punch comes down, it first bends the sides and ends up as at *B*, Fig. 1, and then continues to advance through the die. This brings the projecting ends *N* of the sides into contact with the funnel-shaped grooves *M*, Fig. 2, which lap or fold the ends over. The pieces *E* hold the tabs upright until the lapping of the ends has proceeded far enough to hold the tabs in position.

As the funnel-shaped grooves have one side higher than the other, the ends of the box are folded or lapped over in a natural manner with no interference or danger of the ends striking each other. The shape assumed by the blank in going through the funnel-shaped grooves in the die is shown at *L*, Fig. 1. The punch pushes the blank entirely through the die, and the lower edge of the die opening acts as a stripper upon the return stroke of the press.

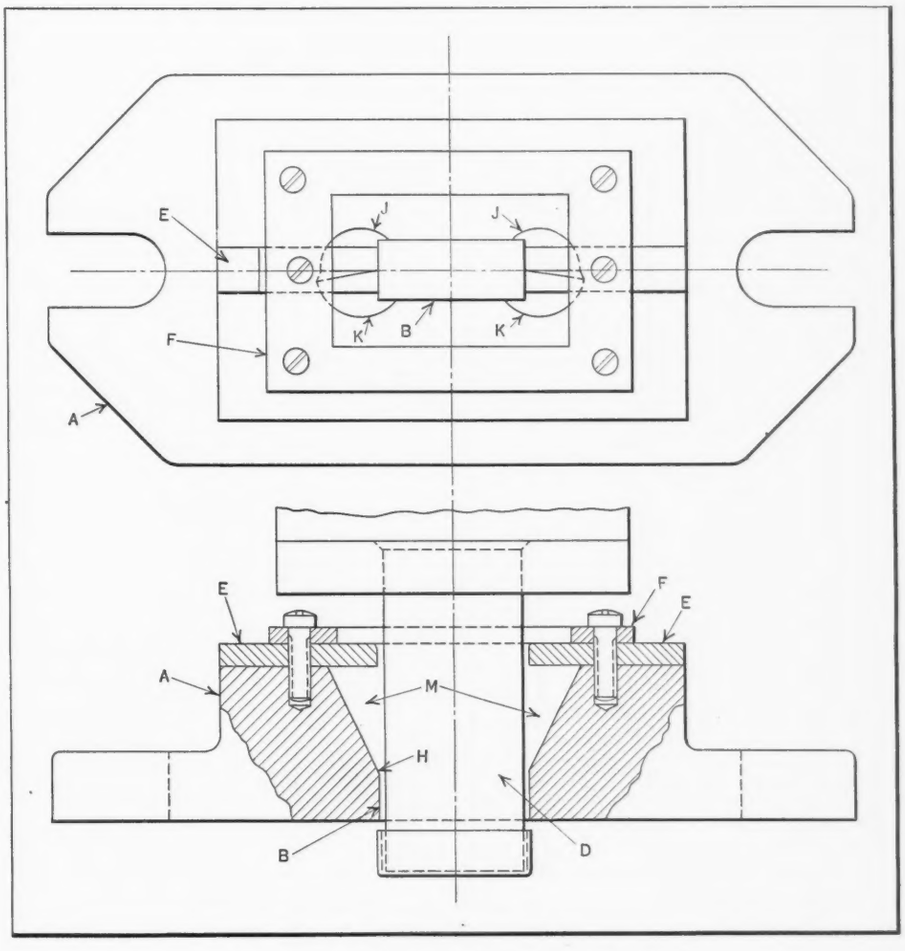


Fig. 2. Die for Forming Paper Box at One Stroke

Cutting-Off Die Designed to Facilitate Resharpening

By F. E. WERTHEIM, Chicago, Ill.

Many shops besides those specializing in structural work are called upon to cut off structural angles. Various types of dies are used for this purpose, but the majority usually have one shear blade like that shown at *A* in Fig. 1. (See page 208.) This blade is effective, but as a rule, sharpening by grinding the comparatively large surface *A* is a slow and expensive operation.

Fig. 2 illustrates a simple shearing die which is suitable for cutting structural

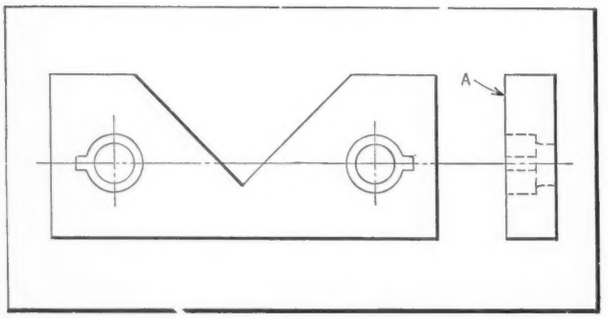


Fig. 1. Ordinary Shearing Blade for Cutting Structural Angles

angles when a slight burr or distortion is not objectionable. For accurate work that must be free from burrs, it is, of course, necessary to use a different type of die having clamps designed to hold the work securely in place. The lower shear blade for the die in Fig. 2 is in two sections, each of which has only about one-half the area of the blade shown in Fig. 1. To sharpen the blade sections, surfaces *B* are ground. These surfaces are so easily ground that the press-hand may be entrusted with the maintenance of the die. Dies of this type are particularly well adapted for cutting off quantities of angles in sizes of, say, from 2 to 4 inches, especially in shops where such materials are intended for ordinary fabrication.

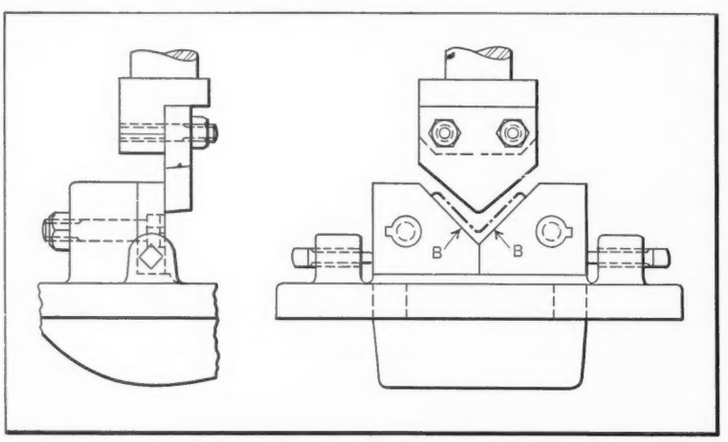


Fig. 2. Shearing Die with Lower Blade Made in Two Sections to Facilitate Resharpening

Gage for Duplicating Tapers

By PETER L. BUDWITZ, Meriden, Conn.

The accompanying illustration shows a gage used for turning tapered work from a duplicate part. It is almost a daily occurrence in the shop for a workman to be given the job of fitting a taper to a machine in some distant part of the plant. Much of the time consumed in going back and forth to try the work in the hole may be saved by setting the gage shown to the original taper and having the new work turned to fit the gage.

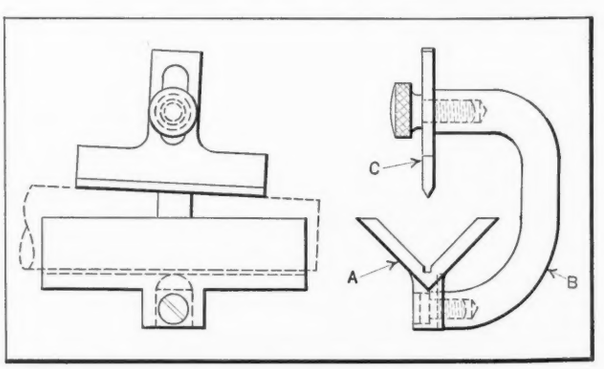
The base *A* of this gage has a vee machined at an included angle of 90 degrees. A slot is milled at the bottom to receive the frame *B*, which is fastened to the base by means of a fillister-head screw. Blade *C* has an elongated slot in it so that it may be adjusted to suit various sizes and forms of tapers. A knurled finger-screw is used to lock the blade after being properly set. The base is hardened and the vee ground accurately. Blade *C* is also hardened, and the measuring edge ground and lapped.

* * *

A Novel Method of Reducing Accidents

Accidents had been occurring with startling regularity in a large rolling mill. Safety talks, inspections, and all known methods of protection had been employed, but still accidents persisted. One day the management had an inspiration. It was decided to have the men at the cold-rolling job wear white pants instead of the usual greasy overalls.

Everybody laughed and joked about the "cold-rolled dudes," the first morning the white-clad crew worked in their new uniforms; but somehow, the idea appealed to everyone in the finishing department, and the next morning other white-garbed workers appeared. By the third day, every man in the department was clad in spick-and-span white duck pants. The effectiveness of this unusual practice in reducing accidents, as related by Nelson N. Marshman of the Cleanliness Institute, was very remarkable. Apparently, the psychological effect of the clean white garb was sufficient to induce the workmen to clean up their working places and exercise greater care in their work, thereby reducing the number of accidents. This shows that it pays not to overlook any possible means of preventing accidents.



Handy Gage with Adjustable Features for Duplicating Tapers

Many Shop Problems Discussed at Buffalo Meeting

Both Automobile Production Engineers and Machine Tool Builders Were Represented on the Program of the Production Divisions of Leading Societies

IN conjunction with the Metal Exposition held in Buffalo during the first week of October, the Shop Practice Division of the American Society of Mechanical Engineers and the Production Division of the Society of Automotive Engineers held meetings at which a number of important papers were read. L. F. Maurer, works manager of the Pierce-Arrow Motor Car Co., and Alex Taub, development engineer of the Chevrolet Motor Co., both dealt with the designing engineer's relation to manufacturing problems (see page 214). R. D. Prosser, of Thomas Prosser & Son, spoke on "Current Applications of Cemented-carbide Tooling" (reviewed later in this article), and C. R. Maxon, of the New Jersey Zinc Co., on "Special Zinc Alloys for Die-castings." The latter two papers were illustrated by motion pictures.

"Recent Trends in Machine Tool Design" was the paper read by Guy Hubbard (see December number); "The Influence of Oil Compressibility on Speed Characteristics of Hydraulic High-speed Presses," by Walter Ernst, of Hydraulic Press Mfg. Co.; and "The Torque Required to Tap Cast Iron," by J. E. Miller, professor of machine design, Iowa State College. R. E. W. Harrison, well-known grinding machinery designer and production engineer, presented a paper on the "Technique of Size Control in Precision Grinding" (reviewed later in this article). Louis H. Morin, chief engineer of the Doehler Die Casting Co., spoke on "Design of Products to Utilize Die-castings instead of Machined Parts"; and J. V. Emmons, metallurgist of the Cleveland Twist Drill Co., presented a paper on "Materials for Modern Cutting Tools (to be reviewed in a coming number of MACHINERY). At a luncheon meeting, Kenneth Condit, Editor of the *American Machinist*, spoke on "Adjusting Equipment Policies to Meet Changing Conditions."

The New Carbide Cutting Tools are Discussed

In his paper entitled "Current Applications of Cemented-carbide Tooling," Roger D. Prosser mentioned that during recent months the technique of the manufacture of certain of the cemented carbides has progressed to a considerable extent, and a number of different grades especially suitable for different applications have been produced. At first, there was merely "tungsten carbide," and it was necessary to apply one general grade to the whole range of applications, from rough-hogging on steel down to light finishing cuts on non-ferrous materials—sometimes without the best of success. Today, the art has progressed to a point where, by the proper selection of a grade suitable for the job to be done, some remarkable savings in manufacturing costs are being obtained.

Referring specifically to Widia, Mr. Prosser called attention to a grade that has been developed especially to meet the needs of the automobile manufacturer. This grade is called Widia L-31. It is designed for work where long tool life between grinds, fine finish on the work, close tolerances, and great resistance to abrasion are desired. This material is very hard and should be used for light cuts where the chip pressures are not very great. When so used, it will hold its edge longer and produce a better finish than some of the tungsten-carbide materials made for more general use.

This grade of Widia, because of its lasting qualities between grinds, is also being used successfully on tools that require a large amount of grinding—reamers, broaches, end-mills, and forming tools.

The author also referred to the recently developed Widia X grade, which is designed especially for the machining of steel at high speeds. [Complete information on this grade of tungsten carbide has been previously published in MACHINERY (see December, 1931, page 296, and May, 1932, page 770.)]

Grinding and Size Control

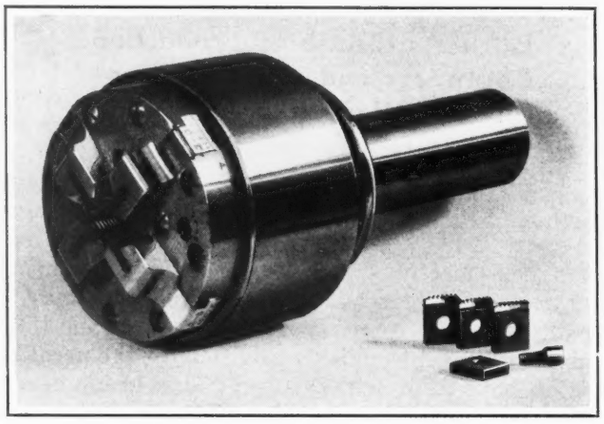
In his paper dealing with size control in precision grinding, Mr. Harrison dealt in a most complete and fundamental manner with the various points that must be taken into consideration in obtaining satisfactory work—that is, work with accurate dimensions and satisfactory finish in grinding operations. Briefly, Mr. Harrison dealt with the following points: The intelligent use of limit systems; the necessity of setting the widest possible limits consistent with correct functioning; the service of the precision grinding machine; finish and its bearing on initial wear; the cost of obtaining correct sizing in grinding machines; the elements in grinding machine design affecting the degree of precision that can be obtained in a given machine; the elements of design that affect the time factor in securing size control with close tolerances; the grinding machine as an inspection unit; and tool and gage accessories available for use on cylindrical and surface grinding machines.

Power Consumed by Self-Opening Die-Heads

By C. W. BETTCHER

Secretary, Eastern Machine Screw Corporation, New Haven, Conn.

Results of Tests Conducted to Determine the Amount of Power Consumed in Cutting Threads of Varying Sizes and Pitches on Different Materials with Self-Opening Die-Heads



Self-opening Die-head with Insert Chasers Used in Determining Power Required for Cutting Threads

As very little information has been recorded concerning the power required to cut threads with self-opening die-heads, the Eastern Machine Screw Corporation, New Haven, Conn., decided to collect data on this subject. A motor-driven H & G threading machine, with a revolving die-head, was equipped with a special tailstock for holding the work. The spindle of this tailstock, which was hardened and ground, was free to turn under the action of cutting the thread. It was kept from revolving by means of a torque arm connected with a scale. The readings on the scale were easily converted into net foot-pounds. The torque, in foot-pounds, was then translated into torque horsepower by means of the following formula:

$$\text{H.P.} = \frac{2 \times 3.1416 \times (\text{Torque in ft. lbs.}) \times \text{R.P.M.}}{33{,}000}$$

$$= 0.0001904 \times \text{R.P.M.} \times \text{Torque}$$

In order to make sure that there were no undue frictional losses in the spindle and that the results obtained represented actual power consumed in cutting the thread, the readings were checked by means of suitable wattmeters connected with the leads to the motor. The actual wattage required in cutting the thread was taken as the difference between full load and no load. The wattage readings were converted to horsepower and were found to check with the torque horsepower calculations very closely. The torque-arm method was then adopted for the tests as being more convenient.

The interesting factors to be investigated were as follows:

1. *Sizes*—How much power is required to cut threads of the ordinary sizes?
2. *Diameter*—With a given pitch and speed, how does the power vary with the diameter?
3. *Pitch*—With a given diameter and speed, how does the power vary with the pitch?
4. *Material*—For a given thread size and speed, how does the power vary with different materials cut?
5. *Pitch Diameter*—For a given material and speed, how does the power vary with adjustment for pitch diameter?
6. *Multiple Threads*—For a given diameter, pitch, and speed, how does the power vary with the helix?
7. *Dullness*—For a given diameter, pitch, and speed, what is the effect on power when the chasers are dull?

The insert-chaser type of die-head shown in the accompanying illustration was used in making the tests.

Power Required for Cutting Different Sizes of Threads

In measuring the power required to cut the thread sizes ordinarily used, the die-head was adjusted to cut the basic pitch diameter. Bessemer screw stock was used as the material threaded, because of its uniformity. The results of this test are shown in Table 1. Many sizes not shown in the table were also checked; but as the results were consistent, it seemed unnecessary to include them. All the chasers used in this test were new. The speeds employed were 100, 200, and 400 revolutions per minute.

Effect of Diameter on Power Required

It will be noted from the table that for a given pitch and speed, the power varies almost directly as the diameter. Expressing this another way: For a given pitch and material, the power consumed is almost in proportion to the speed in surface feet per minute. As might be expected, the foot-pounds torque for a given size thread is practically the same for all speeds. The horsepower for a given thread size varies directly as the speed, as would be expected from the formula.

Power Varies in Proportion to Square of Pitch

For a given diameter, the change in power for a change in pitch varies almost in proportion to the square of the pitches. This relation is sufficiently close so that, knowing the power consumed for one diameter and pitch, the power consumed by another pitch thread of the same diameter can be roughly approximated.

Since the power varies directly as the diameter, the speed, and the square of the pitch, it is possible, when the power required to cut one thread size is known, to find the approximate power required for another at any speed.

A rough formula for making this calculation is as follows:

$$HP_x = HP_a \times \frac{S_x}{S_a} \times \frac{(p_x)^2}{(p_a)^2} \text{ where}$$

HP_a is known horsepower taken by thread size a;

HP_x is the unknown horsepower for another thread size x;

S_a is the speed, in surface feet per minute, of thread a;

S_x is the speed, in surface feet per minute, of thread x;

p_a is the pitch of thread a; and

p_x is the pitch of the other thread x.

Results of tests of power consumed for cutting different classes of material are shown in Table 2.

Table 1. Horsepower Required for Cutting Threads of Various Sizes at Different Speeds with Self-Opening Die-Heads

Diam. of Thread, Inch	Number of Threads per Inch	Thread-cutting Speed, R.P.M.	Net Torque, Foot-pounds	Horse-power	Cutting Speed, Surface Feet per Minute
1/4	20	100	2	0.039	6 1/2
1/4	20	200	2	0.078	13
1/4	20	400	2	0.155	26
5/16	18	100	3 1/4	0.063	8
5/16	18	200	3 1/4	0.126	16 1/4
5/16	18	400	3 1/4	0.252	32 1/2
3/8	24	100	2	0.039	10
3/8	24	200	2	0.078	20
3/8	24	400	2	0.155	40
3/8	16	100	4 1/4	0.082	10
3/8	16	200	4 3/8	0.170	20
3/8	16	400	4 3/8	0.340	40
1/2	20	100	4 1/8	0.080	13
1/2	20	200	4 1/4	0.165	26
1/2	20	400	4 1/2	0.349	52
1/2	13	100	8	0.155	13
1/2	13	200	8 5/8	0.335	26
1/2	13	400	9	0.698	52
5/8	18	100	6	0.118	16 1/4
5/8	18	200	6 1/4	0.233	32 1/2
5/8	18	400	6 1/2	0.504	65
5/8	11	100	14	0.272	16 1/4
5/8	11	200	14 1/4	0.553	32 1/2
5/8	11	400	14 1/2	1.115	65
3/4	16	100	9	0.175	20
3/4	16	200	9 1/4	0.359	40
3/4	16	400	9 1/2	0.737	80
3/4	10	100	21	0.407	20
3/4	10	200	22	0.854	40

The power required for the different materials is all specified in relation to that taken by Bessemer screw stock, since the latter material is uniform and perhaps the best known. All comparisons in this table were taken for the same thread sizes at the same pitch diameter and the same speed.

It must be borne in mind, in reviewing these figures, that there is some variation in machining qualities of material bought from different sources of supply, due to the fact that many materials, if not ordered with special machining qualities, will not machine well. Therefore, results quite different from those obtained in this test might be encountered where the machining properties differed from those of the samples tested here.

The effects on power consumption for slight adjustments over and under the basic size are shown in Table 3. In this table the power for cutting the basic pitch diameter is given as 100 per cent.

Power Requirements for Cutting Multiple Threads

In order to keep the diameter and pitch constant and vary the helix, it was necessary to test multiple threads. With the power required for cutting a single thread specified as 100 per cent, the results from multiple threads of the same diameter and pitch were as follows: Double threads consumed 220 per cent, showing that the power was a little

Table 2. Comparison of Power Required for Cutting Threads on Different Materials with Self-Opening Die-Heads*

Material	Power Required, Per Cent	Material	Power Required, Per Cent
Screw Stock	100	2320	121
Brass	63	2330 Heat-treated	147
Aluminum	45	Stainless (14 Chrome)	
Bolt Stock	90	free-machining No. 5....	121
1020	110	Stainless (18-8) free-	
1045	127	machining.....	140
1335	127	Chrome Nickel (88 Per cent	
3135	121	Nickel-12 Per cent Chrome)	177
3140	137	1045 Heat-treated	168

*Comparisons in this table are based on screw stock, which is taken as 100 per cent.

Table 3. Effect of Increasing or Decreasing the Pitch Diameter on Power Required for Cutting Threads with Self-Opening Die-Heads*

9/16-18 Thread		5/8-11 Thread	
Pitch Diameter	Power Required, Per Cent	Pitch Diameter	Power Required, Per Cent
0.535	82	0.574	89
0.530	91	0.570	97
0.5265	100	0.566	100
0.525	104	0.561	107
0.523	109	0.560	109
0.520	113	0.559	110
0.516	118	0.555	116

*Power required for cutting threads with basic pitch diameter given as 100 per cent.

more than twice that of the single thread. For cutting quadruple threads, the power required was approximately 450 per cent of that consumed in cutting single threads.

Dull chasers that had been run so long that the threads cut would not pass inspection required almost twice the amount of power consumed by a sharp set of chasers.

Interesting Facts Brought Out by Tests

Many of the interesting points brought out by the tests described deserve further investigation. For example, when chatter developed while cutting a thread, it was found that the power required was almost 50 per cent greater. Pipe threads would be another subject for investigation. The few tests made on taper pipe threads indicated that they take over twice the power required for straight threads. The small number of tests made in cutting Acme threads showed that they consumed very little more power than the National Standard form threads of the same diameter and pitch.

Still another fact demonstrated was that it takes no more cutting power to start a thread than to continue the cut after the chasers are well on the work. The average operator would naturally think that more power is required for starting, but he overlooks the fact that when the chasers are on the work and maintaining their own lead, they still are having just as much work to do.

A practical application of the data in Table 1 is in connection with drag on threading spindles, tailstocks, slides, or whatever the element is that must move forward as the thread is cut. Take, for example, a spindle that, after the thread is started, is supposed to advance by means of the pull of the die-head; that is, the spindle is not cam-fed for the entire length of the thread. The drag effect of the spindle can be determined by giving it a known torque, say 9 foot-pounds for a 1/2-13 thread and then observing whether it can be moved freely. Often it is found that the drag from a faulty spindle, when under the torque normally required to cut a given thread, is greater than the chasers could be expected to carry.

The information contained in this article, which only covers threads of the National Standard form, is preliminary in nature and was not gathered with the expectation that there would be no inaccuracies or discrepancies. It represents simply a start along these lines. The plan is to collect additional data.

* * *

Officials of the Labor Department of New Jersey have found that the accident frequency in the smaller shops of the state is higher than in the larger plants. For that reason, the Commissioner of Labor has made a special appeal to the smaller plants to enter the annual state-wide safety contest during the last quarter of the year. Last year 825 plants enrolled in this contest.

Forty-Three Die-Castings Used in Construction of New Lathe

The extensive use made of die-castings in every line of industry is well known. However, few men in the mechanical field are aware of the fact that in a lathe recently placed on the market, as many as forty-three die-castings are used. This application of die-castings has been made in a new lathe built by the Atlas Press Co., Kalamazoo, Mich., a lathe that was designed to sell at a very low price. In order to produce a good lathe at low cost, it was found necessary to embark upon new construction methods and to adopt new materials. The builders of the machine considered die-castings, but at first questioned whether they would have the required strength. However, they soon learned of the great developments that have been made in die-casting metals and concluded to make use of the die-casting metal known as "Zamak-2," developed by the New Jersey Zinc Co. Laboratory tests have shown that this metal has a tensile strength of from 40,000 to 45,000 pounds per square inch, a strength greater than that of cast iron, and possesses wearing qualities superior to steel.

Experience has shown this metal to be satisfactory for the purposes for which it is used in the construction of the machine mentioned. Gears, gear housings, gear carriers, pulleys, handwheels, and graduated dials are among the parts that are die-cast. The die-castings have an added advantage in that there is assurance that all duplicate parts will be uniform in size, since they are made in the same master die. The builders of the lathe state, as an indication of the satisfaction that these die-cast parts have given, that the question has occasionally been raised about the use of die-cast parts *before* purchasing or using the new lathe, but there has not been a single complaint about the die-castings *after* the machine has been put in operation.

* * *

American Machinery and Tools Institute Contest

The American Machinery and Tools Institute, 40 N. Wells St., Chicago, Ill., announces that the Institute will award certificates of merit for the best papers of not over 1500 words submitted on each of the following four subjects: (1) Present-day advantages of machinery and tools. (2) Subjects for simplification and standardization in the machinery and tools industry. (3) Effect of temporary dies on the machinery and tools industry. (4) Economic justification of the small machine or tool shop.

The papers will be judged according to ideas submitted, grasp of subject, usefulness of the paper for publicity purposes, and neatness. The closing date of the contest will be December 31, 1932. Entry blanks can be obtained from George R. Tuthill, executive secretary, 40 N. Wells St., Chicago, Ill.

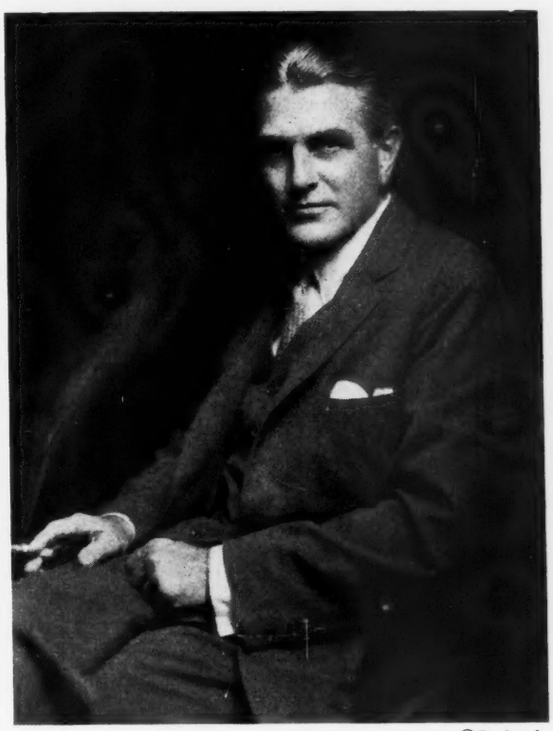
Machine Tool Builders Discuss Pressing Problems of the Industry

THE National Machine Tool Builders' Association held its thirty-first annual convention at Swampscott, Mass., October 9 to 11. A joint meeting with the Associated Machine Tool Dealers followed the convention. The annual meeting of the Associated Machine Tool Dealers was also held during the same week.

New officers for the coming year were elected by the machine tool builders. Henry S. Beal, assistant general manager of the Jones & Lamson Machine Co., Springfield, Vt., was elected president, succeeding Robert M. Gaylord, president of the Ingersoll Milling Machine Co., Rockford, Ill., who has served as president during the past year.

Edward A. Muller, president and treasurer of the King Machine Tool Co., Cincinnati, Ohio, was elected first vice-president; Richard A. Heald, secretary-treasurer of the Heald Machine Co., Worcester, Mass., second vice-president; and F. H. Chapin, president of the National Acme Co., Cleveland, Ohio, treasurer.

Three new directors were elected: J. G. Benedict, treasurer and general manager of the Landis Machine Co., Waynesboro, Pa.; H. H. Pease, president of the New Britain-Gridley Machine Co., New Britain, Conn.; and C. J. Stilwell, vice-president of the Warner & Swasey Co., Cleveland, Ohio.



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Henry S. Beal, Newly Elected President of the National Machine Tool Builders' Association

Mr. Gaylord, in his opening address to the Association, briefly reviewed the conditions in the machine tool industry and its problems. The Association's new general manager, Herman H. Lind, also referred to the conditions in the industry, making a comparison with the business situation in other fields.

The major part of the meeting was devoted to discussing problems pertaining to the industry, and the best means of their solution. J. Wallace Carrel, vice-president and general manager of the Lodge & Shipley Machine Tool Co., and chairman of the Committee on Dealer Relations, presented a report on "Standard Agency Contracts." Observations on the conditions in Europe were made by F. A. Geier, president of the Cincinnati Milling Machine Co., and F. H. Chapin, president of the National Acme Co. Hon. Marcus A. Coolidge, U. S. Senator from Massachusetts, also addressed the convention. Professor E. H. Schell, of the Massachusetts Institute of Technology, read a paper on "Tomorrow's Problems in the Machine Tool Industry." A presentation of the "Share-the-Work Movement" was made by Col. L. S. Horner, vice-president of the Bullard Co.

At the joint meeting with the Associated Machine Tool Dealers, four papers were read as follows: "Closer Cooperation with Our Manufacturers," by J. R. Vandyck, Vandyck-Churchill Co.; "Time Sales," by E. P. Blanchard, sales manager, Bullard Co.; "The Value of the Trade Acceptance Movement," by Col. L. S. Horner, vice-president, Bullard Co.; and "Selling Machine Tools, 1907-1932," by Harry Barney, Barney Machinery Co.

At the joint dinner of the machine tool builders and dealers, an address was made by Ambrose Swasey, one of the founders of the Warner & Swasey Co. and dean of the machine tool building industry. A. W. Robertson, chairman of the board of the Westinghouse Electric & Mfg. Co., spoke on industrial rehabilitation.

Mr. Robertson, who is heading the movement for placing the industrial plants in the United States on a modern basis as far as equipment is concerned, emphasized that practically every plant has a great deal of obsolete equipment that is unprofitable to operate. He pointed to the signs that indicate a definite up turn in business and advised those present to investigate their plants thoroughly in order to make sure that their equipment is such as to make economical production possible. He mentioned that his own firm was prepared to undertake extensive work in the rehabilitation of its plant to meet the demands of the not distant future.

Manufacturing Equipment to Meet the Needs of the Designer

IN a paper read before the Production Meeting of the Society of Automotive Engineers at Buffalo early in October, L. F. Maurer, works manager of the Pierce-Arrow Motor Car Co., pointed out that the designer requires greater flexibility or versatility in tools and equipment. The development of special-purpose machines with fixed center spindles, said Mr. Maurer, offers very slight possibilities of salvaging equipment when a major change is made in the design of the product. The expense of new equipment has frequently prevented the making of desirable improvements; hence, designers feel that equipment should be so constructed that changes can be made at a reasonable cost to suit the equipment for the manufacture of an improved product. In these days, when expenditures are restricted, the problem of securing equipment that can be adapted to various uses is especially pressing.

Continuing, Mr. Maurer said: "Equipment manufacturers have made a marked improvement in both standard and special-purpose machines, so that alterations can be made in much less time and at a lower cost. However, there is still room for improvement.

"It is always dangerous to prophesy, as it is so easy to be wrong; but it is probable that in the next five years we may see rather radical changes in the automotive industry, some of which may even threaten the existence of present manufacturing methods. Consequently, a very close contact between the machine tool builder and the product designer should be mutually profitable."

Suggested Improvements in Methods and Equipment

Mr. Maurer briefly outlined some of the improvements in tooling, equipment, and methods that are being looked for by the designer:

1. Less costly means of changing center distances and number of spindles in multiple drilling and tapping machine.
2. Greater ease in changing centers and number of spindles without loss of accuracy and rigidity in cylinder-boring equipment.
3. Greater ease in changing over milling equipment.
4. Improved method of finish-boring cylinders to closer limits.
5. Improved methods of finishing small-diameter holes in both cast iron and steel.
6. Equipment for cheaply producing hardened-steel cylinder liners.
7. Equipment to produce high-carbon rolled-steel brake-drums more cheaply.
8. Further improvement in the production of quiet gears.
9. Improvement in obtaining concentricity of valve seats with valve guides.
10. Improved method of holding connecting-rod forgings to uniform weight.
11. Machining pistons and connecting-rods to uniform weight with an automatic weighing device.
12. Methods and equipment for producing welded chassis frames. This is a combined engineering, equipment, and cost problem; if solved, it would aid in securing frame rigidity.
13. Means of reducing the cost of body and chassis sheet-metal dies. Much progress has been made along the lines of building dies in sections, so that in case of changes, only certain parts need altering; but there is still room for improvement.

The Product Designer Wants Flexible Shop Equipment

In another paper, read by Alex Taub, development engineer of the Chevrolet Motor Co., the subject "How the Design Engineer Views Manufacturing" was discussed. In this paper, also, the need for flexibility in shop equipment was emphasized. The designer is frequently hampered by the fact that the machine equipment in the shop is suitable only for the production of a certain type of equipment. A change in design would involve added expenditures for machinery and tools.

One of the greatest obstacles to progress in design, said the author, is expensive tools. Hence, both large and small tools, whenever possible, should be designed with facilities for changing. As an example of machines that hamper the designer, the author pointed to cylinder-boring equipment provided with fixed heads. After such equipment is once installed, there is great reluctance to make changes in the engine design, although such changes may be deemed highly desirable. In some instances, engines have been changed so as to have larger bores without changing the center distances between cylinders. This compromise has been made simply in order to suit the manufacturing equipment. "The redesigned engines," said the author, "may be bigger, but certainly they are not better."

Good engineering ideas or principles have often been discarded because the designs could not be produced economically with present equipment. The suggestion was made that the designing engineer call in the machine tool specialist as a consultant on designs when they are still on the board. This might lead to the successful production of designs that previously were considered impracticable, because of the cost of production.

Suggestions for Inter-Industry Planning

A Brief Outline of the Reasons for Inter-Industry Planning and the Methods by which it can be Accomplished

By L. M. WAITE,* South Norwalk, Conn.

THERE are three questions that are almost invariably asked of me after any discussion of inter-industry planning: (1) Why do you consider inter-industry planning a necessity? (2) What legislative enactments would you suggest to make steady employment a permanent condition? (3) What mechanism would you set up to make the advantages of inter-industry planning available?

In so far as possible, I will briefly answer these questions in sequence, interspersing comments that may not seem exactly relevant to the question answered, but that, nevertheless, are relevant to the three questions considered as a unit.

Why is Inter-Industry Planning a Necessity?

1. A casual glance at graphs of the ups and downs of business—that is, of employment and purchasing power—showing a record of business activity since such records began to be kept is proof that any economic program, to be successful, must contemplate the widest possible distribution of the products of labor, as an incentive to work and effort.

2. The most certain way to insure contentment with an economic system is to provide steady purchasing power. This is a perfectly normal human characteristic, as evidenced by the early desire of youth for some sort of allowance.

3. Our employment problem, from the viewpoint of purchasing power, is one concerning the collective individual, not the single person; it is a question of collective industry, not of the individual enterprise.

4. The unvarying law of compensation—every action has an opposite and equal reaction—acts in business as in mechanics. If we employ everybody in production, everybody will be able to participate in consumption. Our ability to produce is unlimited, while our ability to consume will be restricted as long as we adhere to our economic set-up without modifications. Therefore, we should locate dead lines of production until we can change them to meet increased consumption. Consumption is furthered by planned leisure and increased in variety by education.

5. Employment is a social problem. The history of nations that have disintegrated reveals that their collapse was due to their inability to solve their social problems.

These are a few of the reasons why inter-industry planning is a necessity—certainly there are many others.

*Author of "You, Me, and Business."

What Legislation is Needed to Make for Steady Employment?

1. My inclination is *not* to over-exalt the power of legal enactment, unless there is a widespread indication of the general acceptance of the principles involved in the proposed legislation.

2. To start the ball rolling, I would suggest only enough legislation or change in existing enactments (1) to enable business, through trade associations and the like, to demonstrate its cooperative resourcefulness (an aptitude as yet unproved) to the end that there may develop a more uniform ability to consume the products of industry and agriculture; and (2) to take the guesswork out of what that probable ability to consume is. This involves time for experimentation; otherwise, evidently, we will continue the existing economic impasse until such time as its attempted abolition becomes a function of government.

3. It is evident that there will be, of necessity, departmental cooperation with a government agency, and I would suggest enough additional legislation to put cooperative teeth into the Federal Trade Commission to the end that it may have some power, even without the aid of decisions of the Supreme Court. We are dealing with a national policy in the interest of the general good. The constitutionality of such an effort cannot be questioned, if the preamble of the constitution of the United States means anything; nor can its wisdom be subject to a Supreme Court review prior to its operation in some form. Therefore, some modification of existing restrictive enactments, and, if necessary, of the Fourteenth Amendment, may be required, so as to permit of cooperative judgment as to (1) the wisdom of certain phases of production, and (2) the general welfare ethics of certain phases of competition. Decisions as to new policies should be based upon the lessons of experience rather than upon judicial decisions as to original intent.

4. The details of this constructive legislation should be worked out through cooperative conferences and agreements between trade associations and the like, as representatives of business; and government authority must be provided to enforce the agreements determined upon.

The Mechanism Required to Make the Advantages of Inter-Industry Planning Available

1. Present trade associations should be used as a nucleus for a wider participation in industry planning by a greater number of industrial organizations.

2. A central organization should be established in Washington that would have access to and would increase the value of already available statistics and information. This organization should be available for constructive work, cooperating with the government, and should supersede part of the "locust swarm of lobbyists" that are now more or less necessary as watch-dogs against harmful legislation.

3. A prime factor for the success of inter-industry planning is the availability of accurate information at all times as to employment conditions in all branches of industry throughout the country. Such information must not only be accurate, but must be constantly available, non-political, and kept up to date from week to week.

4. If it is governmentally wise to assume that war is always in the offing, and to constantly spend untold millions in preparedness for such an eventuality, we are equally justified in assuming that depressions are never far removed and that it is good business to spend money in preparing to meet the difficulties arising from them. The expense connected with trade association work frequently limits the membership and keeps out many desirable cooperative minds. For this reason, and in view of the importance of preparedness against any approaching unemployment, as compared with the necessity of preparedness for war, I suggest that trade association expense be borne by the Department of Commerce and provided for from funds derived, for example, from a tax on the transfer of all securities that change ownership through sale more frequently than once in three months. I believe that we could raise $10,000,000 in this manner, which is less than the cost of one airplane carrier used in preparedness for war. Through such a tax, profits derived from highly organized speculation, which is generally conceded to have a destructive effect on industry, would pay the cost of an attempt to maintain the market value of securities which speculative activities tend to keep in a state of disturbance. A tax of this kind would in no way detrimentally affect a legitimate investment market.

5. I would establish voting rights within associations on a basis that would prevent larger corporate interests from dictating policies to the exclusion of men who have successfully demonstrated their ability to direct all departments of smaller businesses. In other words, I would nationalize the experience and judgment of thousands of business men who have not only demonstrated general ability, but who are in far closer touch with the human side of employment than the chief executives of, say, three hundred of our largest corporations. By such provision I would divide the load of responsibility, which fact, in itself, would insure the hearty cooperation of men to whom we are often pleased to refer as "captains of industry."

6. Such a plan would recognize the fact that periodic unemployment is a major social problem, the control of which may be the test of the ability of American business to organize for a steady purchasing power. We would enter into a stage of cooperative research and experimentation, such as George Washington must have had in mind when he said: "Experience is the surest standard by which to test the real tendency of the existing constitution."

The Cheerful Side

J. A. Fay & Egan Co., Cincinnati, Ohio, manufacturer of woodworking machinery, writes us that it has recently received several good-sized orders, two of them being the largest of the kind ever booked by the company. The new business will keep some of the departments of the company's large plant in Cincinnati busy for several months to come. R. W. Egan, president, believes that the present low prices cannot remain in effect much longer, and for this reason has placed orders for raw materials, supplies, and stock used in manufacturing to meet future requirements.

F. A. Merrick, president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has announced that his company is preparing to spend over $1,250,000 for raw materials, supplies, and development work. The required funds are immediately available and will be expended during the next few months.

Roots-Connersville-Wilbraham, Connersville, Ind., manufacturers of rotary positive and centrifugal types of blowers and pumps, report a substantial increase in the volume of business during September. Orders booked were 43 1/2 per cent greater than the total for July, and 26 1/2 per cent greater than the total for August. The volume of orders received during September was 32 per cent greater than the total for the same month in 1931, this being the first increase in 1932 over 1931.

Young Radiator Co., Racine, Wis., reports that a large force of former employes was taken back in July. The company has worked over-time in several departments and also employed part night shifts. The engineering department and research laboratory has been continued without reduction in personnel in the development of new products.

The General Electric Co. is vigorously pushing the construction of its large new power plant at Schenectady, N. Y., which will cost $4,000,000. This plant will be ready for operation next spring. The total amount of construction work on the plant and the tunnel for carrying the steam pipes to the factory will require the labor of more than one thousand men for four months.

The Alumilite Process

A process has recently been developed, known as the Alumilite Process, for applying, by electrolytic means, a protective and decorative coating to aluminum and its alloys in either a plain finish or in a large range of highly lustrous colors. It is possible to obtain a great variety of colors, such as black, green, red, blue, and bronze, in both matte and polished finishes. These finishes are highly resistant to atmospheric and saline corrosion, and are also very hard and long wearing.

According to L. E. Eckelmann, manager of the Metal Finishing Division of the Pyrene Mfg. Co., Newark, N. J., this company has made use of the process for over a year, and during that period has finished a great variety of materials in large quantities. Among other articles to which the process has been applied are washing-machine equipment, brush-holders, ash trays, bottle caps, vanity boxes, switchboard panels, and architectural material.

The process is applicable to articles produced from aluminum sheets, sand castings, permanent-mold castings, die-castings, drop-forgings, and extruded articles. If the original aluminum appearance is desired, a silvery white coating is obtainable. Experience has shown that coatings produced by the new process are more resistant to wear than a good nickel plate.

The Alumilite Process is applied at temperatures not exceeding 200 degrees F., so that no change in the mechanical properties of the metal will take place during the application of the process. The coatings, however, are heat-resistant and will not be affected by heat at temperatures lower than those that would affect the base aluminum itself. The process has been originated and developed by the Aluminum Colors, Inc., 537 E. Washington St., Indianapolis, Ind. This company licenses manufacturers to use the process and maintains an engineering service for the lay-out of installations to operate the process. The Metal Finishing Division of the Pyrene Mfg. Co. acts as general representative in the state of New Jersey.

* * *

The Smallest Complete Ball Bearing Ever Made

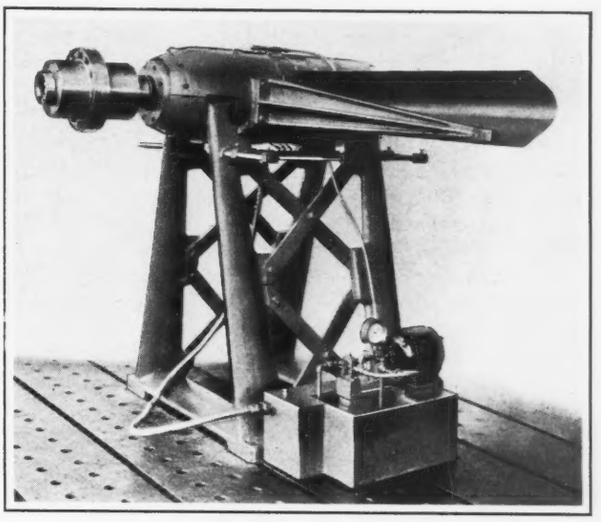
What is believed to be the smallest complete ball bearing ever manufactured has been placed on the market by the Fafnir Bearing Co., New Britain, Conn., for use on instruments and for other delicate applications. This bearing has a nominal outside diameter of 1/2 inch, a hole 1/8 inch in diameter, and is less than 3/16 inch wide. It has 1/8-inch balls.

Two other small bearings of a double-seal design have been brought out by this concern specifically for aircraft applications; however, they are also suitable for other uses. One of these bearings is believed to be the smallest ever offered in the double-seal design, being approximately 5/8 inch outside diameter, slightly over 3/16 inch wide, and having a hole approximately 3/16 inch in diameter. The other is slightly larger, having an outside diameter of about 3/4 inch, a width slightly under 1/4 inch, and a hole about 1/4 inch in diameter. Both of these bearings have a full complement of balls 1/8 inch in diameter.

* * *

An Unusual Type of Dynamometer

The accompanying illustration shows a dynamometer built by the Farrel-Birmingham Co., Buffalo, N. Y., especially for testing geared airplane engines. The small diameter of the gear-case should be noted; yet the capacity of the dynamometer is 1000 horsepower at 1000 revolutions per minute. It can be used for higher powers with higher speeds in proportion. This equipment can be employed for



Farrel-Birmingham Dynamometer for Testing Airplane Engines

testing the horsepower actually developed by the engine and the power actually absorbed by the propeller. In addition, it will test the thrust of the propeller and is so arranged that the thrust can be taken by the dynamometer or can be transmitted to the engine.

The diameter of the housing being limited to 17 inches, the internal members of the appliance consist of internal gears meshing with external tooth pinions. This arrangement permits a small-diameter housing to be used and enables the axes of the driven and driving shafts to be in line. The internal gears are made of Nitralloy. All the transmission bearings are double-row ball bearings, and the trunnion bearings are parallel roller bearings. The torque arm is clearly indicated in the photograph; a shield is placed over it in order to prevent it from being affected by the air stream from the propeller.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies Can be Obtained by Writing Directly to the Manufacturer.

SHEET-METAL WORKING MACHINES AND TOOLS. Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Catalogue 94, illustrating and describing the Niagara line of machines and tools for sheet-metal working, including folders and brakes; rotary machines for burring, turning, beading, flanging, forming, etc.; groovers and seamers; slip-roll formers; snips and hand tools; stakes and roofing tools; lever shears and punches; and squaring and rotary shears. Bulletin 72-D, descriptive of the Niagara line of power squaring shears with capacities for 1/4-inch soft steel and lighter.

LIQUID BATHS FOR HEAT-TREATMENT. E. F. Houghton & Co., Philadelphia, Pa. Booklet discussing the use of liquid baths for the heat-treatment of steel. The booklet treats of the advantages of molten salt baths, and describes the characteristics of the different grades of Houghton's liquid heats for annealing and hardening and Houghton's draw temps for tempering and drawing, as well as the specific applications for which each is adapted. The last section deals with the design and operation of furnaces for liquid baths.

GEAR-CUTTING MACHINES. Gleason Works, 1000 University Ave., Rochester, N. Y. Booklet (Form 600) containing engineering data on large hypoid and spiral bevel gears. The booklet contains complete information on design, application, efficiency, speeds, and horsepower transmission of these two types of bevel gears, besides standard specifications from which the engineer can select gears suitable for his installation. Price lists are included.

STEEL CHAINS. Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill. Catalogue 1192, containing 144 pages on Link-Belt steel chains, ranging in size from the small detachable steel chain (No. 25) having an ultimate strength of 950 pounds to chains having as great a strength as 1,500,000 pounds. Between these two extremes, specifications, dimensions, strengths, and list prices of a large number and variety of chains are given.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Circular 1771-B, descriptive of various types of manually and electrically operated oil circuit-breakers especially suitable for indoor power-house installation where space is restricted. Circular 1958, descriptive of "De-Ion Grid" oil circuit-breakers for indoor service in voltages from 15,000 to 34,500.

GEAR GENERATORS. Farrel-Birmingham Co., Inc., 377 Vulcan St., Buffalo, N. Y. Bulletin 426, containing a detailed description of the Farrel-Sykes 22-foot gear generator which weighs 120 tons and handles gears up to 50 tons. Data are included for some of the smaller medium-sized gear generators made by this company.

CONVEYING EQUIPMENT. Diamond Rubber Co., Inc., Akron, Ohio. Catalogue entitled "How Shall We Handle It?" profusely illustrated with pictures showing conveyor belts in use under widely different conditions. The advantages of the belt conveyor and details of belt construction are discussed.

CONSTANT-TENSION DRIVE. Reliance Electric & Engineering Co., Cleveland, Ohio. Bulletin 602, illustrating and describing the Reliance constant-tension drive for application to any process requiring a constant tension in material being wound on or off a reel.

SHEET-STEEL PRODUCTS. Inland Steel Co., First National Bank Bldg., Chicago, Ill. Booklet covering Inland sheet- and strip-steel products. The data includes standard extras and differentials, weights, bundling tables, standard tolerances, and trade practices.

TOOL-ROOM MACHINES. Pratt & Whitney Co., Hartford, Conn. Circular describing the operating principles and application of the Keller automatic tool-room machine for use in the production of dies and tools and other tool-room work.

ENGINEERING SERVICE. City Machine & Tool Works, E. Third and June Sts., Dayton, Ohio. Circular entitled "Cimatool—Centralized Responsibility," containing information about a tooling job handled by the company.

SCREWS AND NUTS. National Machine Products Co., 4850 Bellevue Ave., Detroit, Mich. Leaflet entitled "Order Out of Chaos," describing a combination cap-screw and lock-washer unit known as the "Brackетite."

COLD MILLS. United Engineering & Foundry Co., Pittsburgh, Pa. Bulletin P-202, illustrating numerous installations of United precision cold mills for the cold-rolling of sheets and strips in all commercial metals.

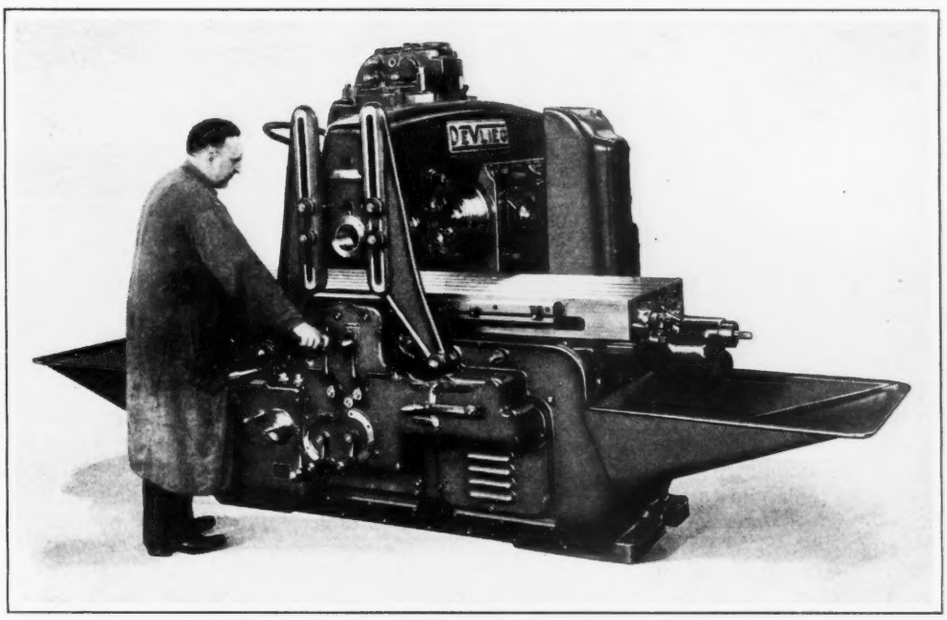
MAGNESIUM ALLOYS. Dow Chemical Co., Midland, Mich. Circulars showing examples of forgings and die-castings made from Dowmetal, a magnesium alloy of extremely light weight.

ELECTRICAL SUPPLIES. Boxill-Bruel Carbon Co., Columbia Park, Ohio. Catalogue 13, listing carbon brushes for single-phase and other fractional horsepower motors.

CAST-IRON PULLEYS. T. B. Wood's Sons Co., Chambersburg, Pa. Circular listing the advantages of cast-iron pulleys.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market



DeVlieg Milling Machine with Automatic Spindle-Positioning Feature

Positioning of the cutter-spindle and its head vertically relative to the top of the table is effected automatically by merely setting a dial and moving a lever on the No. 5 general-purpose milling machine being introduced to the trade by the DeVlieg Milling Machine Co., 1801 Union and Peoples Bank Bldg., Jackson, Mich. This positioning feature is said to be dependable within 0.0005 inch throughout the entire range of the spindle adjustment. The movement of the lever unlocks the spindle head, feeds it to the desired height above the table, and relocks it. The lever and micrometer dial are located at the left front of the machine.

Another important feature of the machine is its complete electrification. Six standard line-start motors drive the various units, there being a 20-horsepower motor for the main spindle, a 2-horsepower motor for the table feed, a 3-horsepower motor for the rapid traverse, a 3-horsepower motor for the power vertical feed, a 1/2-horsepower motor for the automatic lock, and a 1/4-horsepower motor for the coolant system. Clutches are not employed for any function. All the motors, with the exception of the largest, are housed within the machine. The control apparatus is mounted on one panel, the switches being coordinated with levers and other mechanical means.

This machine is designed particularly for the field of general-purpose heavy-duty milling, where the possibility of making quick changes and fast set-ups is especially desirable. As on previous DeVlieg milling machines, the spindle head slides on a double column structure. The spindle runs in Timken bearings. Eight spindle speeds, ranging from 18 to 250 revolutions per minute, are available. However, ranges in speed up to from 36 to 500 revolutions per minute are optional.

Sixteen table feeds are available, ranging from 0.8 to 32 inches per minute. However, feeds up to from 1.6 to 64 inches per minute are optional. There is a rapid traverse of 250 inches per minute. Both the feeds and the rapid traverse are operative in either direction. The hardened and ground table feed-screw is equipped with an automatic backlash remover that insures a positive movement to the table. En-

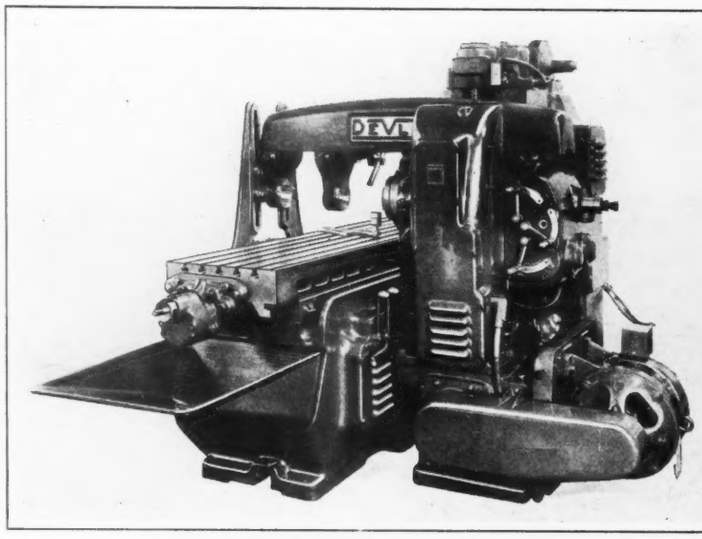


Fig. 1. DeVlieg General-purpose Milling Machine which is Completely Electrified and Has an Automatic Spindle-positioning Provision

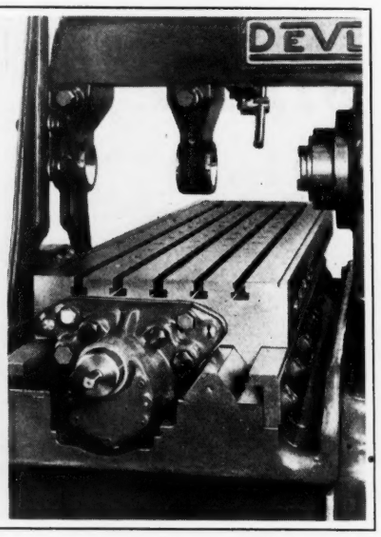


Fig. 2. End View of Milling Machine Table, with its Vee and Flat Ways

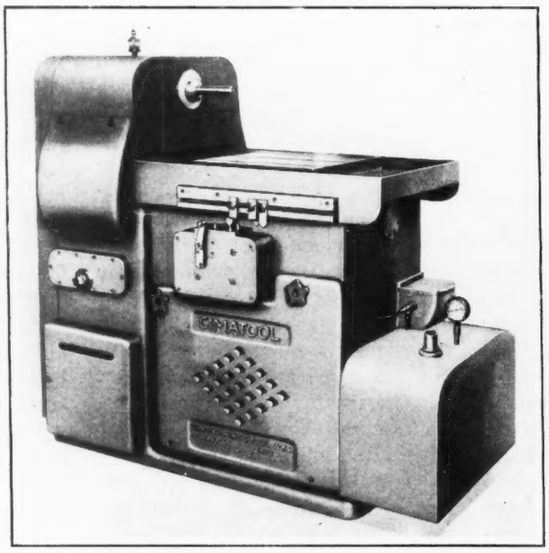
gagement of the feed or rapid traverse is effected without shock. The table unit is arranged for automatic-cycle operation. Fig. 2 shows the vee- and flat-way construction of the table slide.

Eight rates of power vertical feed to the spindle head are obtainable. The regular range is from 2 to 20 inches per minute, but feeds ranging from 4 to 40 inches per minute can be provided.

The spindle speeds are quickly changed by means of levers located at both the front and rear of the spindle head. The controls for the table feed and for starting and stopping are duplicated at the front center of the machine and at the rear of the table. Two levers control the feed and rapid traverse in either direction, while a third controls the starting and stopping of the spindle rotation. The rapid traverse can be employed while the spindle is running or stopped. Vertical adjustments of the spindle head are also controlled from the front of the bed.

Some of the important specifications of this machine are as follows: Maximum distance from center of spindle to top of table, 20 inches standard and 26 inches special; minimum distance from center of spindle to top of table, 3 inches; adjustment of spindle quill, 5 inches; standard table feed, 60 inches (table feeds up to 84 inches may be provided); working surface of table, 22 by 90 inches; and weight of machine, 20,000 pounds.

Cimatool Diamond- or Carbide-Tool Boring Machine



Cimatool Boring Machine Using Diamond and Tungsten- or Tantalum-carbide Tools on Holes up to 6 Inches in Diameter

Holes up to approximately 6 inches in diameter can be bored accurately with the machine here illustrated, which has been designed to use diamond and tungsten- or tantalum-carbide tools. This machine is a product of the City Machine & Tool Works, E. Third and June Sts., Dayton, Ohio. It is built in both single- and double-end types and with one or more spindles to suit various production jobs. It is especially suitable for boring the larger sizes of pistons, connecting-rods, electric motor frames, etc. Cylindrical valves of all kinds can also be bored.

The operation of this

machine differs from that of the bench type described in October MACHINERY, page 149, in that the revolving spindles do not have a feeding movement. Instead, the work is fed to the spindle by a reciprocating table. Like the bench machine, however, it is semi-automatic.

Provision is made for quickly traversing the work to the boring tool. In the case of interrupted bores, there may also be a quick traverse after one bore has been finished, to bring the next bore into position for machining. Upon the completion of the operation, the work is quickly returned to the starting point. The required sequence of traverse and feed movements is obtained through the use of stops on the table, which operate hydraulic valves.

At the end of the operation a stop on the table depresses an electric stop-button. This cuts off the electric power and at the same time permits an electric brake to instantly stop the motor and the spindle rotation. The hydraulic feed still remains operative for quickly returning the table and work.

Semco Deep-Throat Welded Steel Press

A 50-ton press with a welded steel frame has been added to the line of deep-throat punch presses built by the Service Machine Co., 754 Broadway, Elizabeth, N. J. This P-27 1/2 press is of high-speed design, operating at a maximum speed of 125 revolutions per minute. A bolster adapter such as shown on the machine illustrated is regularly provided, but an adjustable bed can be supplied for use with the lighter classes of work, where quick set-ups are desired.

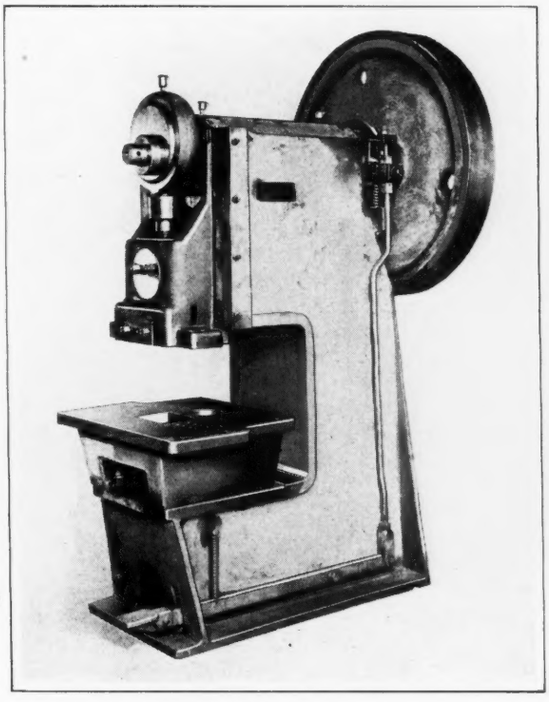
The slide has a hole to receive 3-inch diameter shanks. Two different shank centers are provided, the regular center giving a throat depth of 18 1/4 inches, and the front center a throat depth of 20 1/4 inches. The slide has an over-all width of 23 inches and measures 9 1/2 inches from front to back.

The eccentrics can be quickly interchanged for obtaining various lengths of stroke up to 4 inches. The slide adjustment is 3 1/2 inches, and with standard stroke of 3 1/2 inches, the shut height above the bolster adapter ranges from 5 1/2 to 9 inches, and above the bed from 15 1/2 to 19 inches. Provision has been made for using knock-out bars.

The clutch is of the standard Semco design; it includes a safety non-repeat device that can be disengaged and a reaction switch that insures silent operation.

Pratt & Whitney Universal Die-Sinker

Cherrying cuts can be taken without special cutters or attachments on a No. 2A universal die-sinker now being introduced on the market by the Pratt & Whitney Co., Hartford, Conn. Standard die-sinking tools only are used for either straight or cherrying cuts, and the tools are provided with a power feed.



Semco High-speed 50-ton Press with Deep-throat Welded Steel Frame

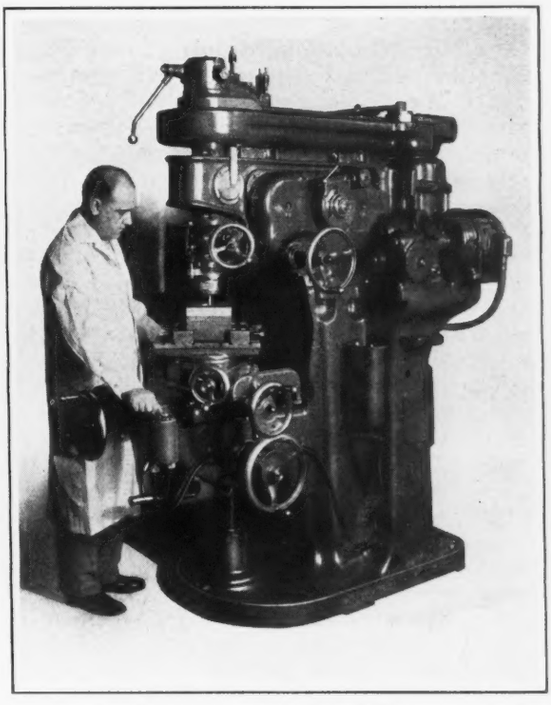


Fig. 1. Die-sinker which Takes Cherrying Cuts without Special Cutters or Attachments

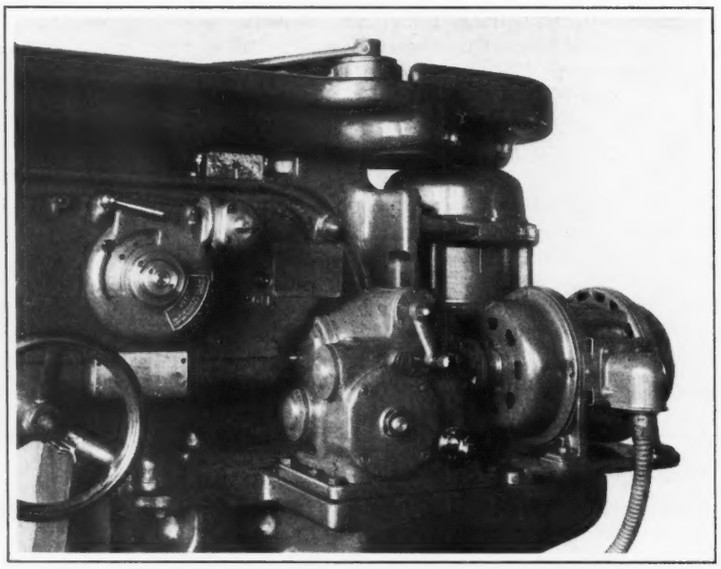


Fig. 2. At the Left is the Mechanism for Setting the Oscillating Head of the P. & W. Universal Die-sinker to the Cutting Diameter

These advantages have the two-fold effect of changing a difficult hand operation into a quick machine operation and of eliminating the need of expensive cutters. The machine is intended not only to lower the cost of machining dies, but also to reduce the amount of hand work required on them.

Operations that are impossible with the ordinary die-sinker, even when equipped with a cherrying attachment, can be performed. For instance, by combining the rotary table feed and the oscillating cutter movement, it is easy to sink a spherical cavity. It is also possible to sink a cherrying cut below the surface of the die. A quarter-cylinder can be cut by feeding the cutter through an arc of 90 degrees and using the longitudinal feed. By using the upper half of the oscillating travel, an inverted cylinder or sphere can be produced either on the surface or below the surface of a die.

The new machine is of vertical design, similar to the No. 2 die-sinker which this concern has built for years, and has the same work range as the older machine. One of the principal new features is the oscillating head by means of which an ordinary die-sinking cutter can be moved through a semicircular path to produce a cylindrical cavity, the correct draft being cut on the die at the same time. Cherrying and straight die-sinking operations can be performed without changing the set-up.

This new die-sinker is made unusually heavy in order to reduce vibration to a minimum and insure smooth accurate cutting. It weighs approximately 6100 pounds, including the motors and electrical equipment. Some of the important dimensions are as follows: Maximum distance from working surface of vise to lower end of spindle, 17 1/2 inches; vertical travel of knee, 16 inches; travel of spindle quill, 2 1/2 inches; distance from column face to center of spindle, 21 inches; longitudinal travel of table, 12 inches; and transverse travel of table, 12 inches. The vise will accommodate die-blocks up to 9 by 10 inches in size.

The handwheels and controls of the machine are arranged in duplicate on each side. Micrometer rings and binders are provided on all slides, and the Pratt & Whitney rotary vise mechanism is included.

The entire oscillating head, including the spindle driving motor, is balanced by a counterweight so that, if desired, it can be moved easily through its entire travel by turning a handwheel instead of using the power feed. The oscillating head is mounted on two eccentrics arranged with an adjustable throw, so that the head can be revolved through any diameter from 0 to 3 1/2 inches to suit the operation. A scale facilitates settings. Heavy binders are provided for locking the head rigidly in position when the oscillating movement is not needed, thus adapting the machine for transverse and longitudinal cuts. On each side of the head housing there is a graduated dial, over which moves a pointer that is attached to the oscillating head. This pointer indicates the position of the cutter at any time during a cylindrical cut.

An individual four-speed motor of 1/4 horsepower rating provides the power feed to the oscillating head. This motor is of the reversing type and is seen in the right foreground of Fig. 2. Eight feeds are available for each spindle speed. A control mounted on the right-hand side of the column governs the four motor speeds, while a lever at the operator's station controls the starting, stopping, and reversing of the motor.

The drive to the spindle is delivered through two sets of V-belts and pulleys equipped with means for adjusting the belt tension. Eight spindle speeds are available, ranging from 300 to 3600 revolutions per minute. The spindle driving motor is of 1 horsepower rating.

A vertical lever at the upper end of the spindle housing provides for engaging either belt drive. It also has a neutral position. A second lever on the left-hand side of the spindle head actuates a brake for stopping the spindle quickly.

The spindle quill is moved by turning the small handwheel above and to the right of the spindle nose. This movement is used both to adjust the cutter in setting up and to accurately feed it downward a short amount. A vertical scale, vernier, and pointer and a positive screw-stop provide for accurate positioning.

Farrel-Birmingham Hydraulic Metal Forming Press

A hydraulically operated forming, bending, and drawing press has recently been built by the Farrel-Birmingham Co., Inc., Ansonia, Conn., for the Chance Vought Corporation, Division of the United Aircraft & Transport Corporation, Hartford, Conn. This press is to be used primarily in the forming of airplane parts. It is of 200 tons capacity and has a 24-inch diameter ram with a stroke of 24 inches.

Individual pump equipment makes the press self-contained. Among the advantages claimed for this construction are a smooth positive action under any load, absence of vibration and noise, minimum floor space requirements, and low installation costs. In addition, the pressure, stroke, and amount of opening between the platens can be varied. Oil is used as the power medium.

The single cylinder of this press is of a double-acting type. The moving platen measures 49 1/2 by 80 inches. It is equipped with renewable bushings which have Alemite lubrication fittings. The bottom platen forms the base of the press.

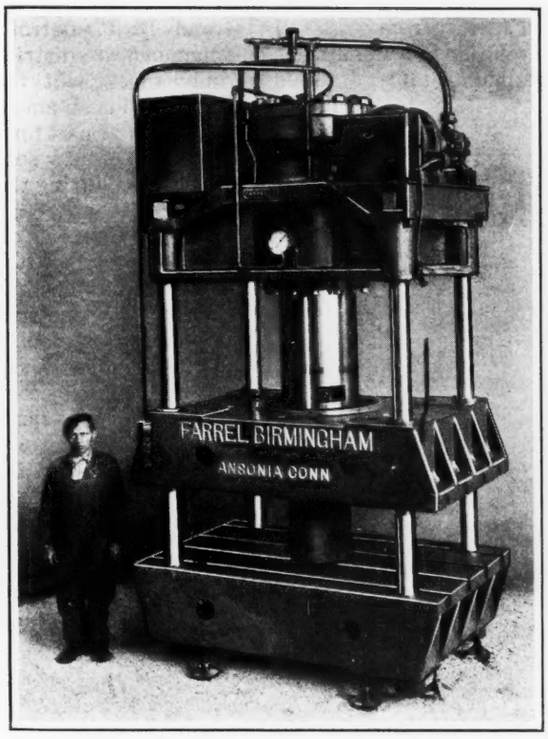
The pump that creates the hydraulic pressure, and the oil supply tank are mounted on top of the press. Quick-resetting relief valves provide for adjusting the pressure on the ram. There are no operating valves, all movements being controlled through a pendent switch having start, stop, and reverse push-buttons. An automatic timing device can be provided to give a dwell of any desired length at the end of the stroke.

Station-Type Hydraulically Fed Multiple-Spindle Drilling Machine

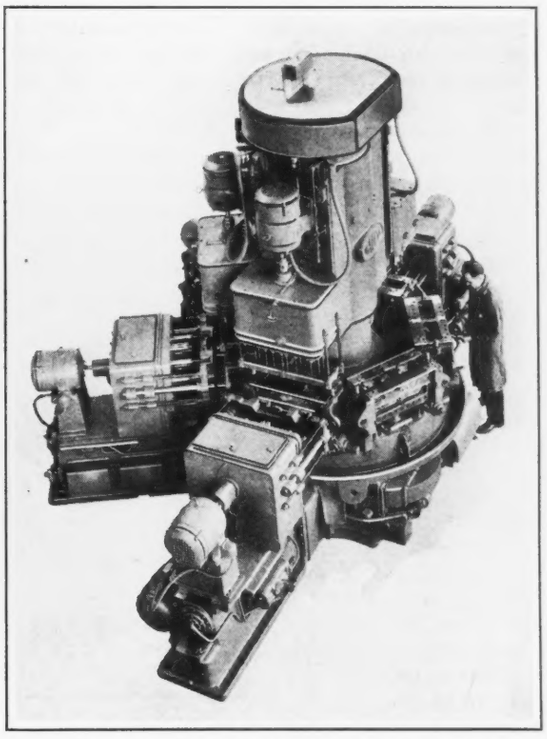
The National Automatic Tool Co., Richmond, Ind., recently developed a station-type hydraulically fed multiple-spindle drilling machine that can be arranged with either three, six, or eight stations. The machine illustrated has six stations, four of which are working stations, the other two being used for loading and unloading. Four vertical and four horizontal drilling heads are provided.

Indexing of the table from station to station is accomplished automatically. The entire machine is so interlocked that the indexing mechanism will not function unless all the drilling heads are in their correct positions.

The Natco Hydro Uni-Power system of hydraulic feed is provided on this machine. This system is semi-automatic and gives the operator complete control through one push-button station. The drilling heads are of a new quick-change type. The spindles are mounted in roller bearings, and are provided with a nose adjustment.



Oil-operated Forming Press Recently Built by the Farrel-Birmingham Co.



Natco Station-type Multiple-spindle Drilling Machine with Hydraulically Fed Heads

The machine here shown performs a total of 132 drilling and countersinking operations in the bottom and manifold side of a cast-iron cylinder block for a low-priced automobile. The production averages seventy-five cylinder blocks per hour. The approximate weight of the machine is 62,000 pounds.

Single-End Bore-Matic Precision Finishing Machine

The Heald Machine Co., Worcester, Mass., has brought out a No. 47 Bore-Matic precision finishing machine of single-end design, intended for use by manufacturers who do not require or care to invest in a double-end multiple-spindle machine such as the No. 46 Bore-Matic described in May, 1931, MACHINERY, page 705. In general construction, the new model follows the design of the previous machine and, like it, uses diamond or tungsten-carbide tools for boring holes to a close degree of accuracy and fine finish.

While the machine is simple in design, as will be apparent from the illustration, it is automatic in operation. Among its features are a fast boring cycle, easy change of boring speeds, and convenience of operation. The machine can be loaded and unloaded from either the front or rear.

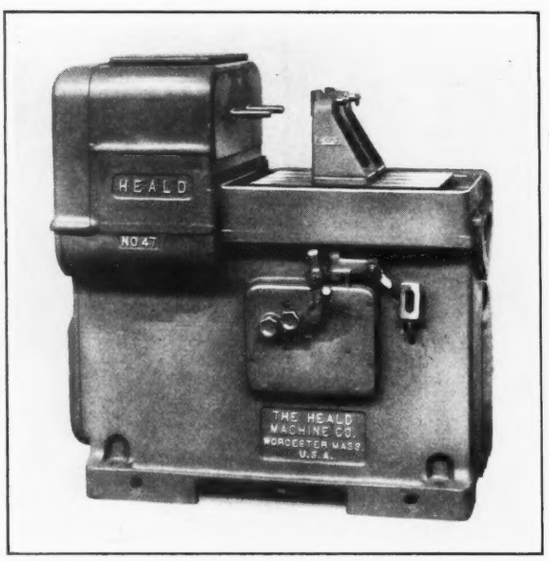
The table is provided with a hydraulic drive which gives any feed from 1 to 25 inches per minute. The base and table ways are completely covered and constantly lubricated. The same boring heads are furnished as on the No. 46 machine. There is a three-position control for these heads, so that they can be started and stopped automatically, readily turned by hand, or run continuously. A 7 1/2-horsepower motor drives the entire machine.

Straight, taper, blind, or interrupted holes can be rough- or finish-bored. Turning and facing can also be done when conditions permit.

From one to four heads can be operated simultaneously, depending upon the work and the operations to be performed. The machine is particularly suitable for finishing free-cutting materials, such as bronze, aluminum, fiber, cast iron, and synthetic plastics.

The manufacturer has standardized on three sizes of boring heads in both solid spindle and quill types.

Some of the important specifications are as follows: Minimum and maximum diameters of hole that can be bored, 5/16 inch (approximately) and 6 1/8 inches (approximately); maximum length of hole, 7 inches (approximately); distance from top of table to center line of standard boring spindles, 8 inches; boring head speeds, from 1200 to 5000 revolutions per minute; and maximum table travel, 14 inches.



Bore-Matic of Single-end Design Intended for Finishing Parts by Using Diamond or Tungsten-carbide Tools

Automatic Welding Head for Heavily Coated Electrode

An automatic welding head designed to use heavily coated electrode has been developed by the General Electric Co., Schenectady, N. Y. This new equipment has a capacity for electrode up to 5/16 inch in diameter, and is rated up to 600 amperes. Its design, however, can be modified for larger electrode and for heavier welding currents. It is stated that the same relative increase in speed between hand and automatic welding can be obtained with this equipment as with the standard automatic head and lightly coated electrode.

Diamond-Impregnated Tool for Dressing Grinding Wheels

A grinding-wheel truing tool consisting of a tungsten-carbide matrix which is impregnated with small crushed diamonds, has just been placed on the market by the Carboloy Company, Inc., 2481 E. Grand Blvd., Detroit, Mich. The diamonds are distributed uniformly throughout the matrix, so as to provide an ample number of cutting points at each new surface reached during the life of the tool.

The advantages claimed for this tool are as follows: The initial cost is low; no further setting or mounting is required; the tool can be used economically on the same grinder and same size of wheel throughout its life; special adapters are not necessary; and there are no moving parts to adjust.

The tool has been used on wheels up to 36 inches in diameter by 2 inches wide, of M hardness, and on centerless grinding wheels up to 20 inches in diameter by 6 inches wide.

Gorton Universal and Vertical Milling Machines

Two milling machines, the 8-D universal type shown in Fig. 1 and the 9-J vertical type illustrated in Fig. 2, have been added to the line of equipment built by the George Gorton Machine Co., Racine, Wis. The first-mentioned of these machines is equipped with a fully universal head that is specially designed for driving small cutters at high speeds on tool, die, mold, and metal-pattern work. The machine is of the same size and has the same cutting capacity as the 8-D vertical milling machine made by the concern.

Both swivels of the spindle head can be revolved through 360 degrees in either direction. They are counterbalanced so that the spindle can be swung with a touch of the hand into any position, where it will remain without being clamped. Large graduated dials permit accurate adjustments within a fraction of a degree. A simplified clamping arrangement enables both swivels to be fastened securely within a few seconds.

A very wide range and great flexibility are obtained by means of the sliding head, at the front of which the spindle head is attached. The sliding head also carries the complete drive to the spindle. This head is quickly adjusted in and out by means of a rack and pinion. It makes possible a cross-feed equal to the longitudinal feed of the table.

Spindle speeds up to 1800 revolutions per minute permit the use of small cutters and drills for work commonly performed with high-speed attachments. A 1/2-inch high-speed steel end-mill can be driven to its limit. Power or hand feed to the table is optional. With a power feed, a motor and gear-box are compactly assembled in the knee as illustrated. A plain knee can be substituted without affecting other parts of the machine.

The range of the universal milling machine is as follows: Longitudinal table feed, 20 inches; table cross-feed, 10 inches; movement of sliding head, 10 inches; total cross-feed (table and sliding head), 20 inches; and vertical feed of knee, 13 3/4 inches. The weight of the machine is 2100 pounds.

The vertical milling machine is also designed for driving small cutters at high speed on tool, die, and mold work, and, in addition, for general manufacturing and production operations within its capacity. High-speed steel cutters from 1/16 to 2 inches in diameter can be used. Thus small work requiring a fast sensitive machine can be handled or heavy cuts can be taken at feeds and speeds comparable to those possible on the Nos. 1 and 2 vertical milling machines.

One of the principal features of this machine is the sliding head, which is similar to that on the universal machine. A power or hand feed to the table is optional on this machine also. Feeds from 0.4 to 30 inches per minute are obtainable with the power feed. Twenty spindle speeds ranging from 250 to 4000 revolutions per minute, are obtainable without back-gears or a special motor, and without changing pulleys. The machine is equipped with a brake for stopping the spindle quickly at any speed. A quick-action lever or micrometer dial feed is provided for the spindle, and there is a positive micrometer depth stop graduated in thousandths of an inch.

Important specifications of this machine are as follows: Longitudinal table feed, 24 inches; cross-feed of table, 12 inches; in-and-out movement of sliding head, 14 inches; combined cross-feed of table and sliding head, 26 inches; vertical feed of knee, 14 inches; vertical feed of cutter-spindle, 3 1/2 inches; and weight of machine, 2900 pounds.

Howell Built-in Capacitor Motors

Capacitor motors with the capacitor built in so that the motors are of conventional appearance and have the advantage of compactness, are being introduced on the market by the Howell Electric Motors Co., Howell, Mich. These motors are available in five fractional horsepower ratings from 1/8 to 1/3 horsepower, inclusive. They are furnished either with waste-packed sleeve bearings or double-sealed ball bearings. For the sleeve bearings, there is a large

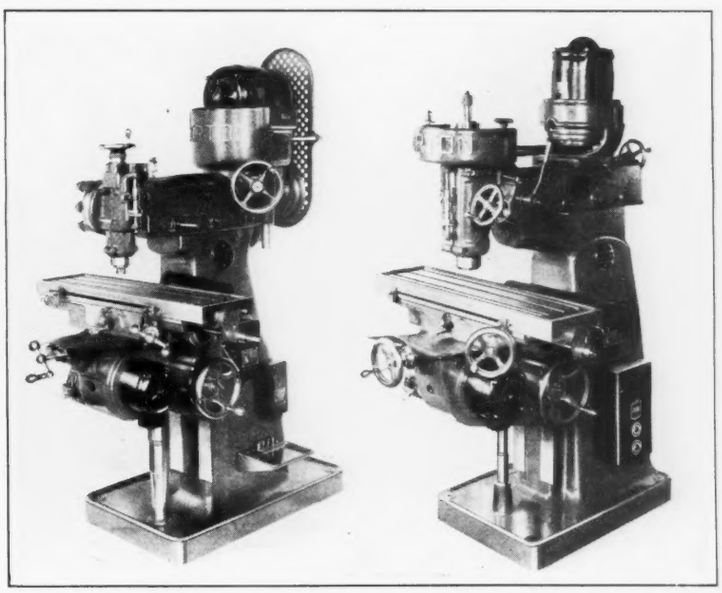


Fig. 1. (Left) Gorton Milling Machine with Universal Spindle Head, Sliding Head, and Motor-driven Table Feed. Fig. 2. (Right) Milling Machine with Vertical-type Spindle Head

oil reservoir and enough wool yarn to insure lubrication for long periods without re-oiling. Ball bearings are grease-packed.

These motors are intended for application to such equipment as refrigerators, compressors, oil burners, stokers, and pumps. They are manufactured in horizontal and vertical types.

Baker Bros. Horizontal Oil-Feed Way-Type Machines

Two horizontal oil-feed, way-type machines of medium and heavy sizes have been brought out by Baker Bros., Inc., Toledo, Ohio, to complete a new series of three sizes, a small size No. 4-HH having been recently introduced to the trade. Simplicity of design and the use of standard parts or units wherever possible have been the aims in developing these machines. Another aim has been to attain a flexibility that will enable the machines to be changed over to meet new production designs.

Standard saddles are mounted on each end of the machines, and these are arranged with drive brackets for driving the multiple-spindle heads. The heads are mounted on the front faces of the drive brackets, a method that allows for substituting new heads at minimum expense. The machine bed itself is made long with a view to permitting the use of the machine for work of various lengths. The bed ways are machined for the entire length and scraped to an accurate bearing with the saddles.

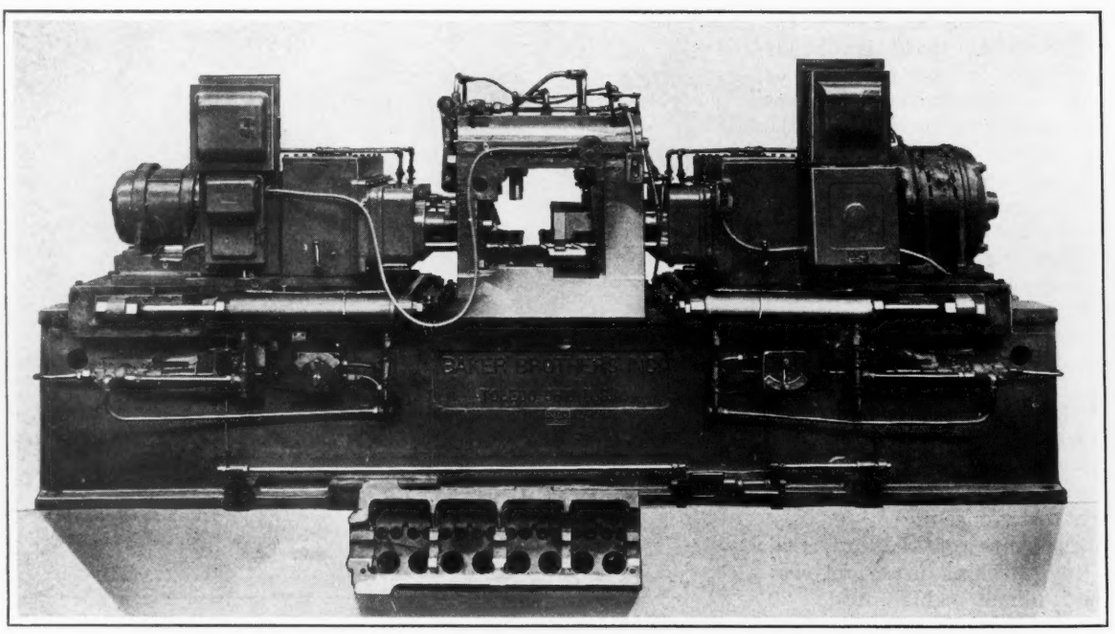
Each end of the machine has an individual oil-feed unit, thus eliminating the need for equalizing devices between the heads or the additional feed parts necessary with only one pump. The "Twin Pull" arrangement consisting of two cylinders in the open and a packing gland adjustment that is readily accessible, is also furnished for each end, as on other Baker machines.

Each machine has an automatic cycle, being started by a foot-treadle at the front. Trip-blocks on the saddles control the cycle. The feed can be changed through two metering valves, one at each end, by moving a lever. A pump on each drive bracket provides automatic lubrication to all bearings and gears in the head.

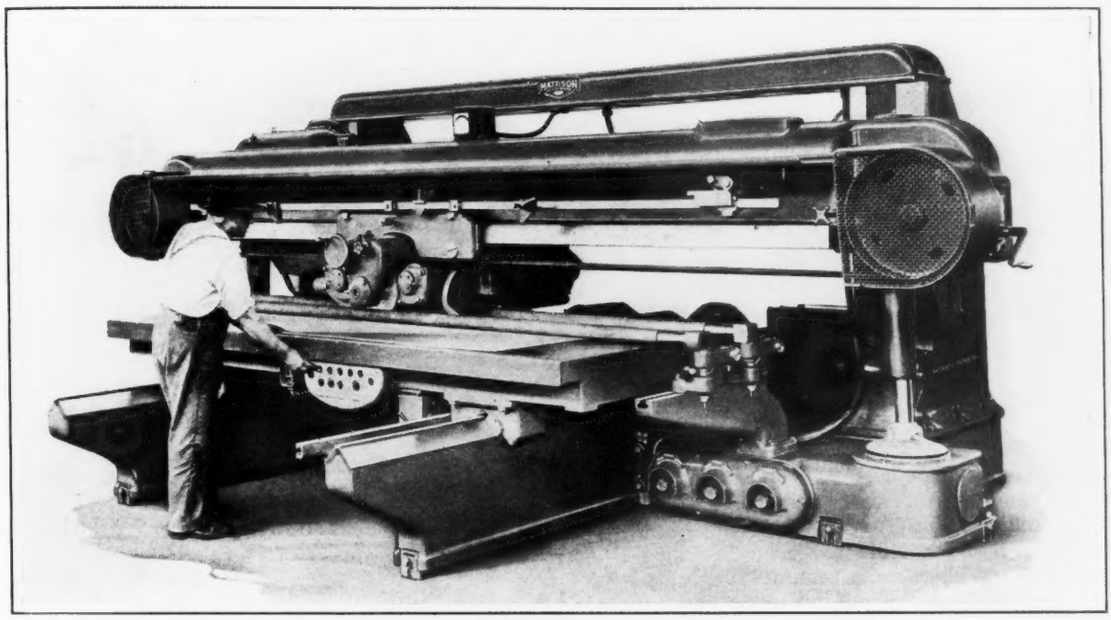
The illustration shows the heavy No. 8-HH machine set up for drilling sixteen valve holes from two directions in an eight-cylinder motor block. Two other machines of this kind were furnished to the same automobile manufacturer. The second machine is used for a second boring of the valve holes and the third machine for reaming them. The machine shown, with the fixture, weighs 17,000 pounds.

Mattison Abrasive-Belt Surface Grinder and Polisher

An abrasive-belt type of machine designed particularly for grinding and polishing sheets of stainless steel is the latest development of the Mattison Machine Works, Rockford, Ill. Abrasive belts over 40 feet long are used. It is claimed that with this length of belt, the individual abrasive grains have time to cool



Baker Oil-feed Way-type Machine Arranged for Drilling Sixteen Valve Holes in Cylinder Blocks from Both Ends



Mattison Abrasive-belt Machine for Polishing Steel Sheets

off between cuts. The belt runs around a contact roll and there is provision for applying a heavy cutting pressure. The stock is removed with a clean cut in the form of shreds or shavings resembling steel wool.

After the steel sheet has been placed on the table, the machine operates practically automatically. A heavy cross-rail, mounted on columns as illustrated, carries tracks on which a carriage reciprocates. The main driving motor is mounted in the carriage head and drives the contact roll. The roll, in turn, drives the abrasive belt. Large idlers at each end of the machine are adjustable for aligning the belt and regulating its tension. The belt is passed over small rubber-covered idler rolls on the carriage head and flexed around the contact roll. This construction aids in dislodging loose particles between the abrasive grains and improves the cutting action of the polishing belt.

The grinding head is mounted on ball-bearing rolls and reciprocates from end to end of the sheet being polished. It is driven by an individual motor on the cross-rail. Stops govern the points of reversal to suit the length of the sheets. The table is water-cooled through an inside circulation system. It is mounted on ball-bearing rollers that run on steel-faced V-tracks. The table is power-actuated through a screw driven by a reversible motor at the rear.

The cross-rail is adjustable on the columns by means of a motor. An indicator graduated to 0.001 inch permits of close power-setting to suit different thicknesses of sheets. The cut is regulated by means of a fine adjusting screw on the carriage head.

In operation, the carriage brings the contact roll into play on the work from end to end, and the table moves slowly crosswise to bring the whole width of the sheet under the contact roll. Thus the sheet is polished over its entire surface, as many passes as necessary being made.

Louis-Allis Splash-Proof Motor

A splash-proof motor that is designed to prevent the entrance of water splashed at it with a high pressure from any angle and at the same time is adequately ventilated and of the same dimensions as standard open motors has been produced by the Louis Allis Co., Milwaukee, Wis. A double baffle in an elliptical air passage in each end-bell permits the free entrance of ventilating air and yet traps and drains any water that may be splashed into the air openings. A shaft guard breaks the force of a stream directed along the shaft extension and prevents water from entering the bearing chamber. An inspection made after a number of severe tests showed the inside of the motor to be entirely dry.

Producto-Matic Milling Machine

The latest addition to the line of Producto-Matic milling machines built by the Producto Machine Co., Bridgeport, Conn., has been designed both for high-production and short-run jobs. This No. 42 machine, here illustrated, can be equipped with different fixtures to suit a wide variety of operations. It is particularly suitable for operations in which the length of the milling cut is short.

All functions of the machine are controlled automatically as, for example, the vertical and

horizontal strokes of the cutters, the indexing, locking and unlocking of the table and, in some cases, the clamping and unclamping of the work. The two-station work-fixture table indexes automatically 180 degrees between each operation. Angular or curved cuts can be taken by merely combining the vertical and horizontal movements of the cutter-slides as required. The cutter-spindle is driven through worm-gearing and change-gears, speeds from 30 to 1400 revolutions per minute being regularly available.

The cabinet base is made in two sections, one of which encloses the drum cam and the transmission for driving the slides and cutter-spindle. This section provides a slide surface for the ram. The second section encloses the table indexing and locking mechanism and provides a mounting for the adjustable work-carrier and the work-fixture table. Change-gears for the feeds and speeds of the machine are confined in suitable chambers.

The machine is completely controlled from the operator's position at the front, where he loads and unloads the work. There are two levers that operate clutches for starting the machine and the feed movements, as well as a motor switch.

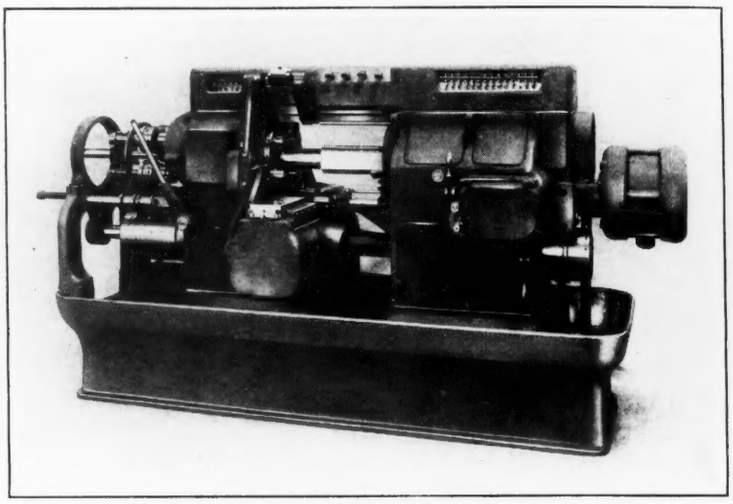


Fig. 1. Gridley Automatic Intended for Work up to 7/8 Inch in Size; High Spindle Speeds are a Feature

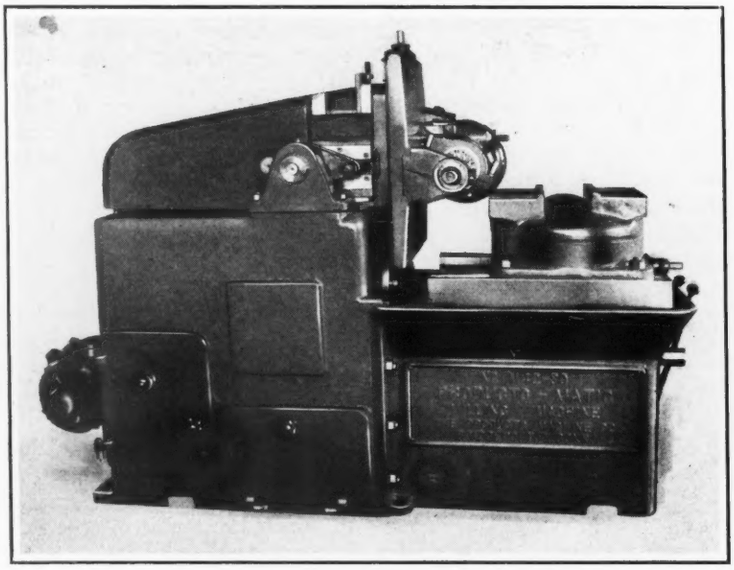
Model R Gridley Automatic

A Gridley automatic that brings into the field of small work the advantages of the Model G-A machine described in June, 1930, MACHINERY, page 819, and May, 1931, MACHINERY, page 707, has been placed on the market by the National Acme Co., Cleveland, Ohio. This new machine, which is known as the Model R, is made in a 7/8-inch size with four spindles.

Higher spindle speeds are provided on the new machine to suit the smaller work diameters. A new feature consists of a fast shockless indexing mechanism that reduces the idle time to a minimum. Another important feature is the accessibility of the tools, as will be seen from Fig. 2. The top slides are set at an angle, instead of horizontally, to facilitate access. Ample chip space is provided, the tool-slide drum being located under the gear-box section of the machine, thus leaving the central space under the tool-slide clear for chips. Forced-feed lubrication to each bearing, automatically controlled, is another important provision. The Chronolog, described in October MACHINERY, page 140, is supplied as regular equipment to insure continuous production, although it is not shown in the illustrations.

There are four cross-slides designed to take heavy forming cuts. An independent cam control is supplied for each cross-slide. Cross-drilling, cross-tapping, milling, and slotting operations can be arranged for in many cases to eliminate the necessity of secondary operations. Anti-friction bearings are provided throughout the machine.

As on the Model G-A machine, a heavy top member ties the gear



Producto-Matic Milling Machine Designed for both High-production and Short-run Jobs

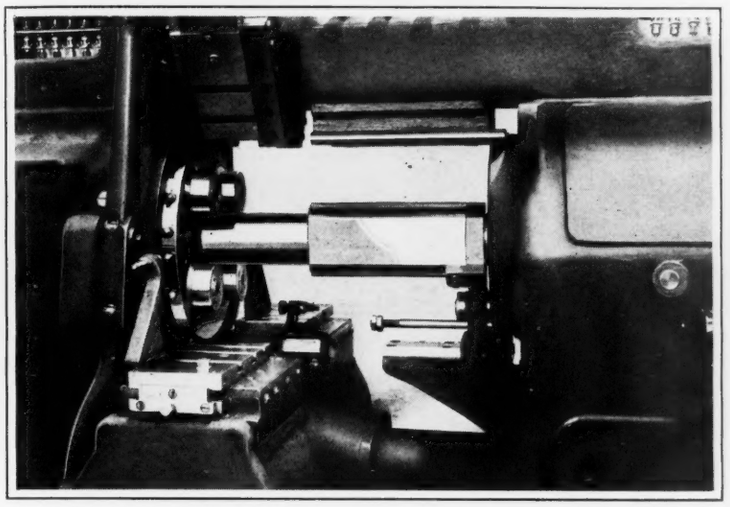


Fig. 2. Accessibility of the Tools and Plenty of Room for Chips are Two Other Features of the New Gridley Automatic

section to the spindle frame to provide the rigidity necessary in taking heavy cuts. The width of the spindle carrier bearings and the over-all length of the carrier have been substantially increased to insure accuracy and long wear of this unit. Also, to insure accurate alignment, the stem of the spindle carrier is integral with the carrier and it is ground in the same setting as the support bearing surfaces. Thus the main tool-slide, which is mounted on the stem, is held in true alignment with the spindles. The high spindle speeds obtainable on the machine permit its economical use for stock far smaller in diameter than the rated capacity. Draw-back collets are used.

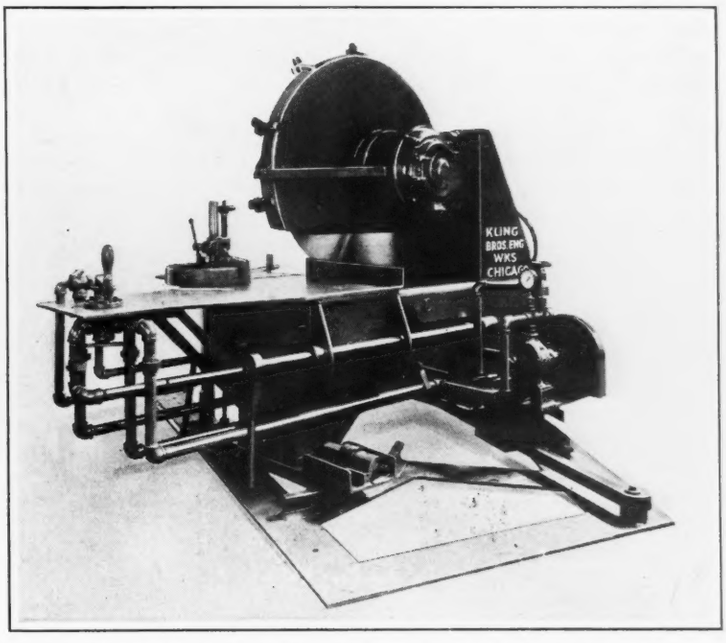
The range of spindle speeds is from 270 to 2580 revolutions per minute. The machine is driven by a 7 1/2-horsepower motor connected direct to the drive shaft, although a motor can be mounted on the top bracket for driving through gears and a silent chain. The net weight of the machine equipped with a motor drive is about 6300 pounds.

Kling High-Speed Friction Saw with Turntable

A high-speed friction saw equipped with a turntable has been added to the line of friction saws recently purchased by the Kling Bros. Engineering Works, 1300 N. Kostner Ave., Chicago, Ill., from Joseph T. Ryerson & Son, Inc. These saws are now distributed through the Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill. The saw illustrated is installed in the Chicago plant of the General Bronze Corporation, and is used mainly for cutting structural steel at angles other than 90 degrees. The machine is particularly suited for this work, because the saw can be quickly swung to any angle between 40 and 90 degrees from the fixed plane of the gage against which the work is held. I-beams up to 15 inches can be cut at an angle of 90 degrees, and I-beams up to 12 inches at an angle of 40 degrees.

The saw blade is 46 inches in diameter by 1/4 inch thick. The advancing blade automatically forces the work into a corner formed by the table and the gage, thus eliminating any necessity for clamping when cutting structural members off square. However, when the work is cut at an angle other than 90 degrees a swivel clamp is used to prevent end motion.

The saw blade is driven by a 30-horsepower motor running at 1800 revolutions per minute. The feed system is of a hydraulic constant-pressure type that causes the blade to exert a steady push against the work. When the operating valve at the front of the table is opened fully, the blade is advanced at the proper rate to start a square cut and continue through the section. In making cuts at an angle, the



Kling Friction Saw Designed for Cutting Structural Steel Accurately at Angles from 40 to 90 Degrees

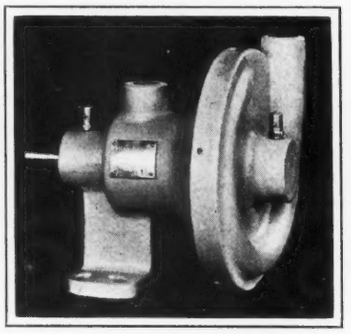
valve is opened only partially at first to feed the saw slowly until both edges of the blade rim have entered the work. Then the valve is opened fully to complete the cut. When the valve is reversed, the saw blade is returned for the full stroke in three seconds.

"Spiral-Flo" Pump

A "Spiral-Flo" pump designed in such a way that closely machined parts within the pump chamber are not necessary to provide efficient operation has been placed on the market by the Tomkins-Johnson Co., Jackson, Mich. The pumping action is obtained through the use of a cast-iron spiral-blade impeller. Either water or oil can be pumped, and the unit is not affected by grit, chips, or foreign matter in the liquid.

When provided with a 1/2-inch intake and a 3/4-inch outlet, the pump has a capacity for delivering 7 gallons per minute at 1000 revolutions per minute and 14 gallons per minute at 1725 revolutions per minute. With a 1-inch intake and 1-inch outlet, 31 gallons can be delivered per minute at a speed of 1725 revolutions per minute.

Ball bearings provide a quiet free-running action. They are protected by standard oil seals. Alemite lubrication fittings are provided. Since there is no appreciable back pressure, no relief valve is necessary. Also, no check-valve is required. The pump needs priming only when first installed. The cap to which the discharge connection is attached can be rotated into any desired position on the housing.



"Spiral-Flo" Pump Made by the Tomkins-Johnson Co.

Racine Grinder for Power Hacksaw Blades

A grinding machine designed to prolong the life of high-speed steel hacksaw blades is being introduced to the trade by the Racine Tool & Machine Co., Racine, Wis. All standard widths and lengths of blades can be handled. The machine is simply designed so as to enable any mechanic to operate it.

Correct vertical and horizontal alignment of the grinding wheel is provided for through adjusting screws, and the wheel is locked in position by means of studs, thereby insuring the maintenance of the proper tooth shape. The blade itself is held in such a position that the teeth are slightly under-cut.

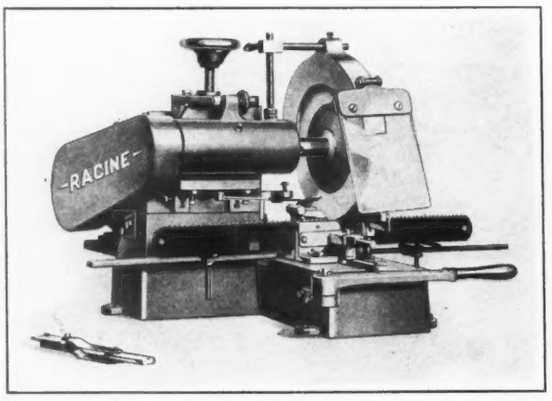
The saw blade is indexed past the grinding wheel. An indexing gage with double fingers positively advances the blade at each stroke of the operating handle, even though three teeth should be missing at any one point. Indexing gages are available for blades with four, six, or ten teeth per inch.

After the machine has been set and the wheel dressed and adjusted for a given size or pitch of blade, all similar blades can be reground in from 1 to 1 1/2 minutes each.

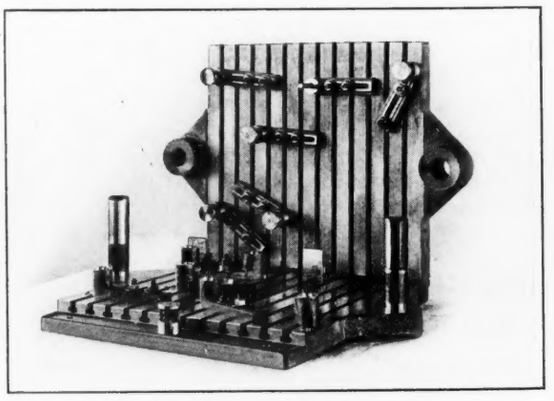
Whistler Adjustable Perforating Die

A perforating die that can be adjusted to pierce holes in sheets up to 1/8 inch thick in any arrangement or grouping that may be desired has been devised by S. B. Whistler & Sons, Inc., 752-754 Military Road, Buffalo, N. Y. The size of the sheets that can be handled is limited only by the press or bolster area.

From the illustration it will be obvious that the location of the punches and dies can be changed in a short time. All the punches and dies can be replaced or changed with the die-holders in the press without disturbing the set-up. The advantage of this design is that new dies need not be made for different jobs.



Machine Built by the Racine Tool & Machine Co. for Regrinding Hacksaw Blades



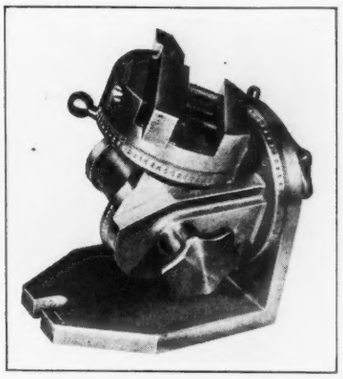
Perforating Die Set in which the Punches and Dies can be Shifted to Suit Different Jobs

Full-Universal Vise

A fully universal vise having three sets of graduations for obtaining any angular setting is now manufactured by the Tool Metals Co., 439 E. Fort St., Detroit, Mich. The graduations run in both directions from zero lines. They are in degrees and are amply spaced to avoid chances of error.

By the use of this vise, a tool bit designed with a back slope, side slope, and angular edge can be quickly positioned in succession to the three angles for grinding. The vise is intended for surface-grinding, milling, and drilling machines. It is made in 4- and 6-inch sizes.

A diamond-holder for truing grinding wheels is built into the vise, making it a self-contained unit for surface-grinding machines. If desired, a three-jaw chuck can be provided in place of the regular vise-jaw body.



Vise with Three Sets of Graduations for Positioning Work at Any Angle

Norma-Hoffmann Ball-Bearing Pedestals

Ball-bearing pedestals, made in sizes to fit standard shafting from 15/16 to 3 1/2 inches in diameter, are being introduced to the trade by the Norma-Hoffmann Bearings Corporation, Stamford, Conn. The ball bearings are of the standard "Precision" double-row self-aligning type with an adapter sleeve. The pedestals have a capacity for a large volume of lubricant, and are equipped with fittings for replenishing the lubricant as required. Felt seals prevent the escape of lubricant along the shaft.

These LUP series pedestals may be obtained with the bearings either floating or fixed in the housing. In the latter case, distance pieces are furnished for clamping the outer ring.

Raydik Bench Drill

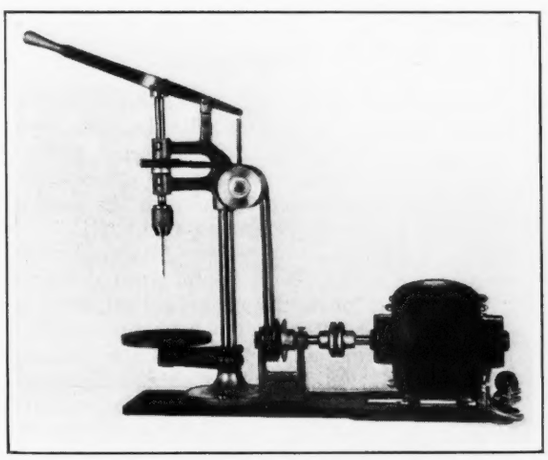
A bench drill adapted for drilling all kinds of metal, as well as wood, has been brought out recently by the Ashley Machine Works, Inc., 714 University Ave., Rochester, N. Y. This drill is known as the "Raydik" and is made as a complete direct motor-driven self-contained unit, as illustrated, or without the motor.

The spindle is equipped with a chuck having a capacity for holding drills up to 5/16 inch. The machine will drill to the center of a 6-inch circle. The distance from the chuck to the table is 6 inches. Power is delivered from the 1/6-horsepower motor to the spindle through a 1/4-inch round belt. The self-contained type weighs 38 pounds, while the separate type bench drill weighs 12 pounds.

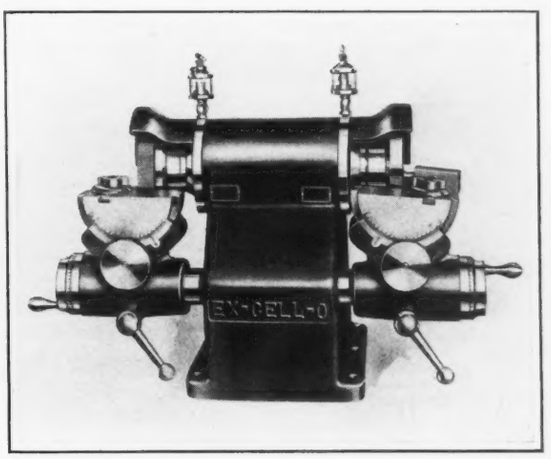
Ex-Cell-O Grinding and Lapping Unit

A grinding and lapping unit designed for sharpening tungsten-carbide boring tools to correct shapes has been placed on the market by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. This equipment is so designed that it can be mounted on a table or pedestal. At the top of the unit is an in-built motor with a double shaft projection, on one end of which is a grinding wheel, and on the opposite end a lapping disk.

The grinding wheel is of the ring type and is 6 inches in diameter. By mounting the wheel on a back plate, its entire thickness of 1 3/4 inches can be used.



Direct Motor-driven Raydik Bench Drill Made by the Ashley Machine Works, Inc.



Grinding and Lapping Machine for Conditioning Tungsten-carbide Tools

The cast-iron lapping disk is also 6 inches in diameter, and 3/4 inch thick. Not only the peripheral edge, but 1 3/4 inches of surface on the front side and 3/4 inch on the back can be used for lapping.

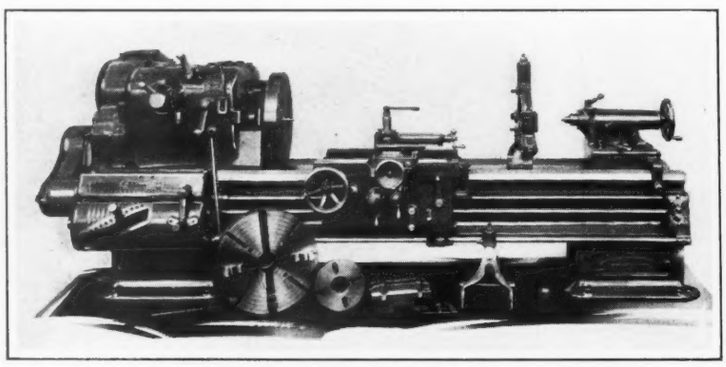
An adjustable table is provided in front of both the grinding wheel and the lapping disk. These tables are supported by brackets mounted on a common shaft. A horizontal micrometer adjustment is furnished for each bracket, and the table proper is mounted on a circular dovetailed slide that is graduated so that it can be accurately adjusted to any angle. The tool support also has angular graduations.

Springfield Ball-Bearing Geared-Head Lathe

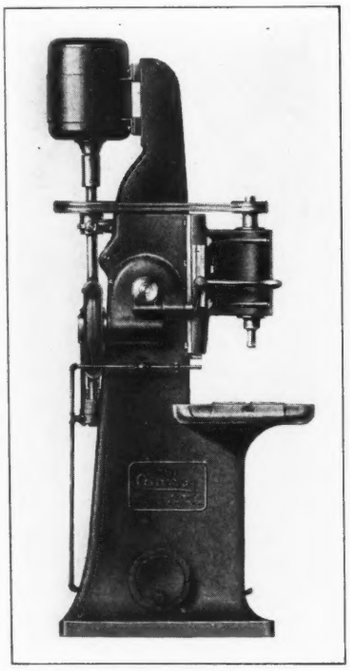
The latest addition to the line of lathes built by the Springfield Machine Tool Co., 631 Southern Ave., Springfield, Ohio, is the 24-inch ball-bearing, geared-head machine here illustrated. Twelve spindle speeds are provided by the headstock, which is fitted with hardened and lapped gears that run in oil. Timken roller bearings are provided for the spindle. The latter has a 2 3/8-inch hole extending through it. A pump equipped with a flow sight-feed gage pumps oil to all principal points of the headstock. The oil drains down into the leg where the reservoir is located.

Thirty-six changes of threads and feeds are available through the gear-box. This unit has a centralized oiling system which lubricates all bearings from two reservoirs. New features of the apron include heavier gears, friction pull-feed handles, and a centralized oiling system. The new handles are guarded to protect them from dirt and to avoid injury to the operator. All bearings of the apron are oiled from reservoirs which filter the lubricant through felt.

The lathe bed has been increased 2 inches in width over previous models. With a 12-foot bed, the lathe weighs 11,450 pounds.



Ball-bearing Geared-head Engine Lathe of 24 Inches Swing, Brought out by the Springfield Machine Tool Co.



Diamond-tool Boring Machine Made in One- and Two-spindle Models

Coulter Diamond-Tool Boring Machine

A Coulter diamond-tool boring machine made in two sizes, each of which can be equipped with either one or two spindles, has been added to the line built by the Automatic Machine Co., Bridgeport, Conn. In the double-spindle design, the spindles are adjustable with regard to center-to-center distance to permit the boring of two holes in one piece or the boring of two pieces simultaneously. While the machine is a production unit, it is so constructed as to bring the price within the reach of every concern requiring this type of equipment.

A cam similar in design to those used on automatic screw machines is incorporated in the feed mechanism. By means of this cam, a roughing or coarse feed is obtained on the down stroke and a finer feed on the up stroke. The boring spindle is equipped with removable bar ends to suit the diameter and length of hole to be bored. An adjustment graduated to 0.0001 inch is provided for the boring tools.

The spindles are driven direct by a 1 1/2-horsepower motor which also supplies power for the feed mechanism and the cutting-compound pump. The compound reservoir is located in the base.

Stecom Gas-Fired Immersion Heaters

Two sizes of gas-fired immersion heaters with heating capacities up to 350,000 and 600,000 B.T.U. per hour, respectively, have been placed on the market by the Steam & Combustion Co., Inc., 1559 Sheffield Ave., Chicago, Ill. These heaters are designed for tanks used in heating soda solutions employed for cleaning metal parts, etc.; for heating liquids such as palm and linseed oils; for oil tempering; and for melting lead. They cannot be applied to acid baths nor for melting metals such as zinc that alloy actively with iron. However, a

method has been worked out in which the spelter kettle used in galvanizing can be carried in a bath of molten lead.

The heaters consist essentially of a gas-fired burner that fires into a submerged refractory lined combustion chamber extended into a pipe coil which is also submerged. The heaters are furnished in two standard constructions, a two-valve type and a proportional mixer or one-valve type.

Phillie Gear Vertical "MotoReduceR"

A vertical type of "MotoReduceR" has been added to the line of speed reducers built by the Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa. The motor and gearing are self-contained in a single housing, so designed as to be practically vibrationless. Misalignment of parts is said to be impossible, and noiseless operation is another advantage claimed.

This motorized speed reducer is particularly suitable for agitators, mixers, and similar equipment, because it requires but a minimum amount of head room. Also, only a small amount of space on the top of tanks is required for support. Structural supports are unnecessary.

All the gears are made from heat-treated nickel steel and have helical cut teeth. All the bearings are of the anti-friction type, the slow-speed shaft being mounted in Timken roller bearings which compensate for upward or downward thrust and take care of the side whip of the extended vertical shaft. This MotoReduceR is available in single, double, and triple types, with ratios up to 450 to 1. It can be furnished with open type or totally enclosed fan-cooled motors, either polyphase or single phase. Direct-current motors up to 10 horsepower can also be provided.

Vertical "MotoReduceR" Made by the Philadelphia Gear Works

Dial Indicator with Spindle through Back

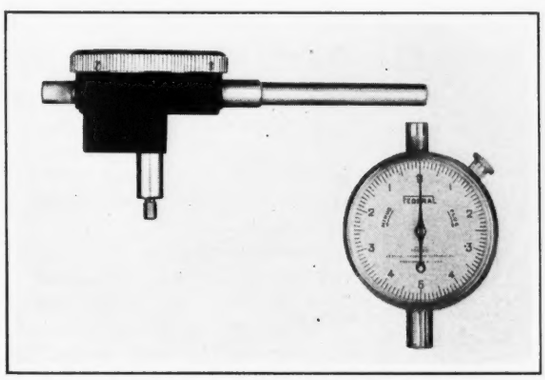
A dial indicator graduated in ten-thousandths of an inch and having a spindle operating through the center of the back instead of through the side of the case has been produced by the Federal Products Corporation, 1144 Eddy St., Providence, R. I. The construction will be apparent from the illustration. This indicator has a range of 0.020 inch. The dial can be furnished with calibrations reading either from 0 to 0.005 inch to 0 or from 0 to 0.10 inch. The indicator is known as Model 82.

D. O. James Flexible Coupling

A flexible coupling designed to give complete flexibility, although it is composed of only three parts, is being placed on the market by the D. O. James Mfg. Co., 1114 W. Monroe St., Chicago, Ill. This coupling, which is shown disassembled, has a floating center member of non-metallic material, self-lubricated by a reservoir within itself.

The center member slides between the jaws of one metal flange on a line passing through the center. Also, it is free to slide across the face of a second flange in a direction at right angles to the first. The flanges are made of nickel iron.

This coupling is made in a range of sizes for transmitting from 0.06 to 127 horsepower at 100 revolutions per minute. The maximum speed ranges are from 9600 revolutions per minute for the smallest size to 1120 revolutions per minute for the largest size.

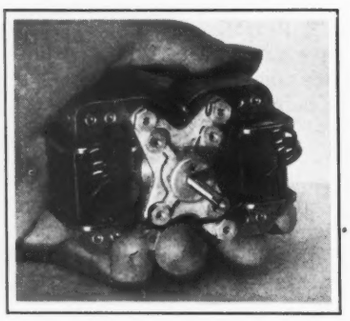


Dial Indicator with Ten-thousandth Inch Graduations and Spindle through Back

Three-piece Flexible Coupling with Self-lubricating Floating Member

Larger Barcol Midget Shaded-Pole Motor

A four-pole motor with a synchronous speed of 1800 revolutions per minute, as compared with 3600 revolutions per minute on previous models, has been added to the Barcol Midget line manufactured by the Barber-Colman Co., Rockford, Ill. The actual no-load speed of the new model is about 1700 revolutions per minute due to the necessary slip between the rotor and the rotating field. At full load the motor delivers 0.0035 horsepower at 1300 revolutions per minute



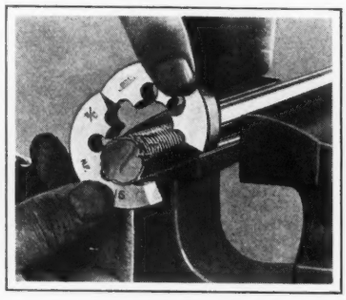
Barcol Midget Motor with a Slower Speed than Previous Models

with an input of 23 watts at 115 volts and 60 cycles. The starting torque is approximately 0.2 pound-inch.

Greenfield "Slip-On" Rethreading Die Sets

A line of "Slip-On" rethreading dies with ratchet stocks, for use in repairing damaged threads, has been placed on the market by the Greenfield Tap & Die Corporation, Greenfield, Mass. These dies resemble an ordinary round die that has been cut in half. The two pieces are held together by a flat spring on the side of the die, but they can be pulled apart and slipped over the clean unbruised portion of a thread in the manner shown in the illustration.

The special ratchet stock is then slipped over the die and the screws tightened, after which the die is backed off over the bruised or torn threads which are usually at the end of the screw. These

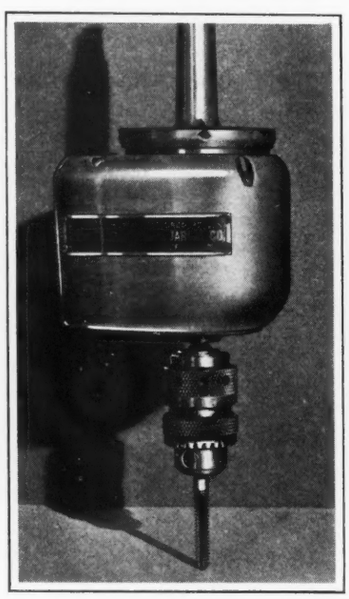


Greenfield Rethreading Die for Smoothing up Bruised Threads

dies are adapted for use on threads of automobile axles, brake rods, studs, etc. They are made up in sets for all sizes of threads from 1/4 to 1 1/8 inches, inclusive, and for both the coarse and fine series American Standard threads.

Biax Tapper

The Biax No. 0 tapper here shown was recently brought out by the Charles L. Jarvis Co., Gildersleeve, Conn. It has a capacity for tapping holes from No. 2-56 up to 1/4 inch in steel. This tool operates at high speed, the maximum speed being 3500 revolutions per minute. Ball bearings are used throughout, and the clutches are self-adjusting.

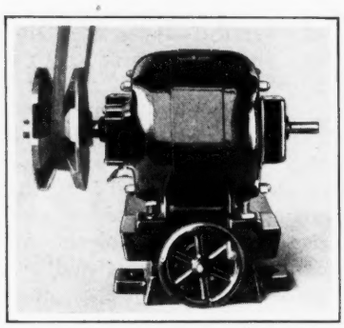


Biax Tapper for Holes up to 1/4 Inch in Steel

The spindle is equipped with a Jacobs double-grip chuck that holds by the square end as well as by the shank.

Variable-Speed Reduction Unit with V-Belt Drive

A variable-speed reduction unit with a V-belt drive, the belt tension of which increases automatically as the load increases, so as to prevent belt slippage, has been brought out by N. J. Oak, 22 Hawthorne St., Lynn, Mass. A reduction in the load reduces the belt tension. The two interlock-



Variable-speed Reduction Unit with Self-adjusting Belt Pulley

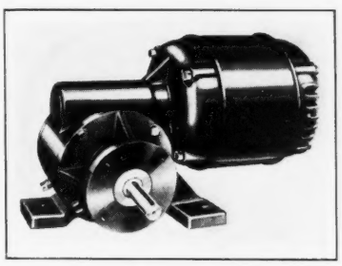
ing cone-shaped flanges that form the driving pulley, as shown in the illustration, are mounted loosely on the motor shaft. The drive is transmitted by pins or keys in the shaft that project outward into 45-degree helical grooves in the hubs of the conical flanges. The helical grooves are of opposite hands and so positioned that an increase in the load increases the pressure on the pins in the grooves, causing the interlocking conical flanges to advance uniformly toward each other. This increases the effective driving diameter and thus increases the belt tension.

The variable-speed adjustment is obtained by the handwheel at the front of the motor base by means of which the center distance between the driving and driven shafts can be adjusted. The unit can be built in sizes from 1/2 to 40 horsepower. Its construction in some respects resembles the positive chain-driven variable-speed units built by the company.

Janette Motorized Speed Reducer

A Type SW-2 motorized speed reducer, recently added to the line made by the Janette Mfg. Co., 556-558 W. Monroe St., Chicago, Ill., consists of a ball-bearing motor built integral with a worm-gear reduction unit. The construction is such that the end frame of the motor is actually a part of the gear housing. The worm is keyed to the motor shaft extension. Tapered roller bearings are provided for the slow-speed shaft.

Twelve ratios ranging from 8 to 1 up to 90 to 1 have been adopted as standard, although intermediate ratios and ratios as high as 120 to 1 can also be furnished. Motors of from 1/6 to 1 horsepower are obtainable, the standard speeds being 1725 and 1140 revolutions per minute.

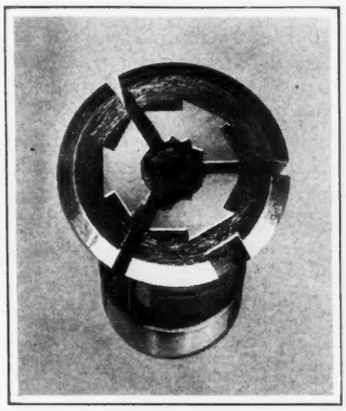


Janette Speed Reducer with Motor End Frame Part of Gear Housing

The unit here shown is provided with a foot and single-flange mounting, the flange being on the right-hand side. A flange can be furnished on the left-hand side as well or on both sides. Also, the unit is available with a foot mounting or with a flange mounting only.

Screw Machine Collets with Stellite Inserts

The collets used in automatic and semi-automatic machines for holding bar stock are usually subjected to severe abrasion. The clamping of the work firmly for machining and then quickly releasing it after the operation is finished soon wears the collets smooth along their burred gripping edges. With a view to increasing the life of such collets, the Enterprise Tool & Gear Corporation, 1552 E. Philadelphia St., Detroit, Mich., has developed collets having inserts made of Stellite.



Screw Machine Collet Made with an Insert of Stellite

On one operation where a hardened steel collet formerly lasted only fourteen hours, it is stated that these insert-type collets have a minimum life of 1000 hours and some have lasted 2000 hours.

Walker-Turner Drill Press and Grinders

The drill press and the grinder here illustrated are recently developed machines of a "Driver" line of small metal- and wood-working machines now being placed on the market by the Walker-Turner Co., Inc., Plainfield, N. J. The drill press, shown in Fig. 1, is designed for high-speed drilling in metal, and for mortising, carving, shaping, and similar operations in wood. It is equipped with a ball-bearing spindle and has a 1/2-inch chuck.

By reversing the position of the drill head and placing the table above it, the drill press is converted into a vertical shaper for wood-shaping with formed cutters. This arrangement can also be used for operations performed by other rotating tools, such as rotary files, that project above the surface of the table.

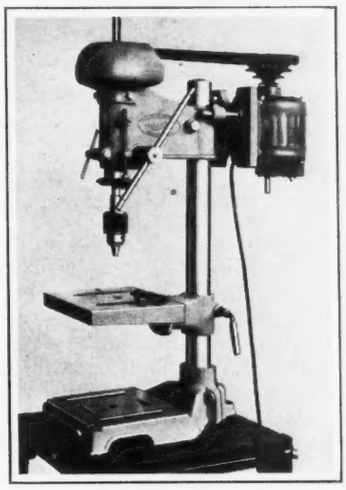


Fig. 1. High-speed Drill Press Made by Walker-Turner Co.

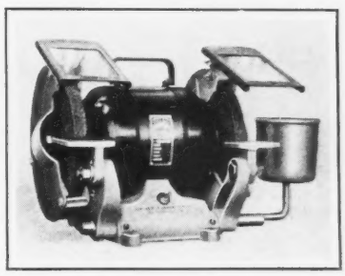


Fig. 2. Walker-Turner Grinder with Tool-rests and Eye Shields

The electric grinder, shown in Fig. 2, is one of three bench-type grinders that can be furnished with motors for operation on 60-cycle 110-volt alternating current or on direct current. A patented device reduces the inrush current to comply with central station rulings. The three styles include one 1/4-horsepower and two 1/2-horsepower grinders.

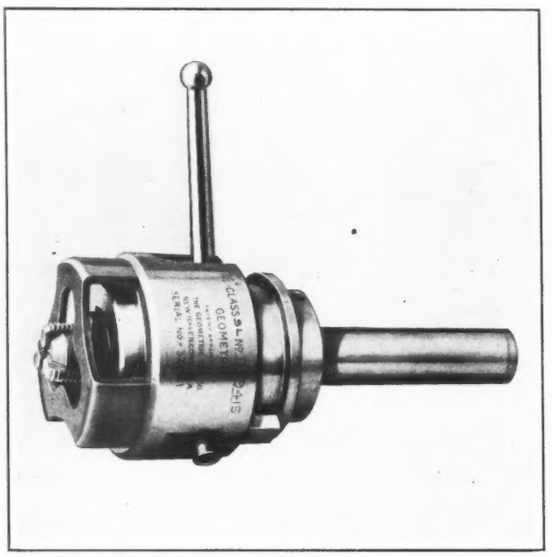
A large variety of attachments are made for these grinders, including attachments for tool grinding, disk sanding, metal cutting with cut-off wheels, and angle-forming with sanding and grinding wheels. The guards on the small machine are for 6- and 7-inch wheels, and on the larger size, for 7- and 8-inch wheels.

Cole Automatic Nut-Lock

A Cole automatic nut-lock, made by the Cole Automatic Nut-Lock Corporation, Elwood, Ind.,

is being placed on the market by the Ohio Equipment Co., Inc., 5716 Euclid Ave., Cleveland, Ohio. The latter company has been appointed sole distributor for this product, which is made in all sizes from 1/2 inch up.

The locking device consists of a flat wire, firmly set in a slot milled in a corner of the nut. The free end of the wire has a right-angle bend that brings the extreme end into contact with the thread at the end of the bolt when the nut is run on. The wire is so formed that it maintains a pressure on the thread at an angle that prevents the nut from loosening, and yet a quarter turn with a wrench serves to release the locking action.



Geometric Collapsing Tap for Holes from 1 to 1 3/8 Inches in Diameter

Geometric Collapsing Tap for Small Holes

A collapsing tap for small holes, which can be used in live spindles or stationary holders without requiring any additional parts, is being introduced on the market by the Geometric Tool Co., New Haven, Conn. This Class SL tap can be tripped by a lever, plate, or spool. It supports the chaser rigidly for its entire length and can be used for tapping to a shoulder or the bottom of a hole without the use of special or overhanging chasers. The same tap, with separate chasers, can be used for both right- and left-hand tapping.

The tap is locked by means of a half ring pawl and stays locked until released at a predetermined point. A wide range of adjustment provides for setting the tool to the required size. The over-all length, exclusive of the shank, is 4 5/16 inches, and the outside diameter is 3 1/4 inches. The capacities are: Straight threads, 1 to 1 3/8 inches, inclusive; pipe threads, 3/4 inch; and lengths, up to 1/2 inch. The coarsest thread that can be cut is 14 per inch.

(Left) Jarvis Screwdriver and Nut Setter. (Right) Flexible-shaft Unit

Jarvis Setter and Flexible-Shaft Units

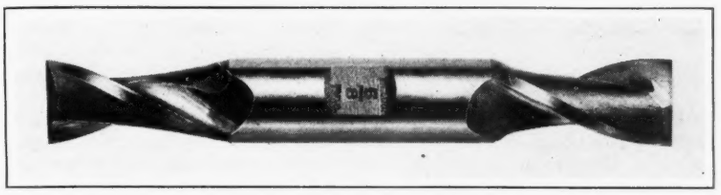
Screws, nuts, or bolts up to and including 1/4 inch in diameter can be driven with a 1/4-horsepower constant-speed setter recently brought out by the Charles L. Jarvis Co., Gildersleeve, Conn. This setter is shown at the left in the illustration. The 3/8-inch Biax-core flexible shaft is 36 inches long. The handpiece has double ball bearings. The mechanical clutch is of the double-ball type, and is easily adjusted for obtaining any tension that may be desired.

Three types of Multi-Jarvis flexible-shaft units for filing, grinding, sanding, and polishing operations are also being placed on the market by this company. They include the roller floor-stand type shown at the right in the illustration, a bench model, and an overhead trolley model.

These units are equipped with a 1/3-horsepower motor which drives through a molded V-type belt to a ball-bearing self-tightening countershaft. Four speeds of 1000, 2000, 4000, and 7000 revolutions per minute are available. The 3/8-inch Biax-core flexible shaft is 42 inches long. The ball-bearing hand-piece with internal precision collet is interchangeable with a high-speed gear type that gives a top speed of 16,100 revolutions per minute. It is also interchangeable with a reciprocating hand-piece.

"Wel-Don" End-Mill for Keyways

A special form of end-mill that can also be used as a drill has been brought out by the Weldon Tool Co., 1426 W. 3rd St., Cleveland, Ohio. This end-mill is particularly designed for the rapid



Wel-Don Two-fluted End-mill which Drills as well as Mills

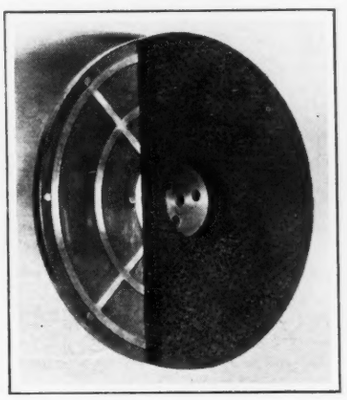
production of keyways. It has cutting edges at both ends and on the sides as well. There is no center hole.

The tool can be fed downward like a drill, as well as horizontally, thus avoiding the necessity for preliminary drilling and for taking several successive cuts to gain the required keyway depth. For best results, it is recommended that this mill be used at high speeds. It is claimed that the double "back-off" on the cutting edges assists in preventing chatter, promotes clean fast cutting, and assists in maintaining the correct diameter for a longer period. Quick changes from one mill to another can be made when the company's standard parallel shank-type holder is employed.

Besly Perforated "Steelbac" Grinding Disk

The Titan Steelbac abrasive disks manufactured by Charles H. Besly & Co., 118 N. Clinton St., Chicago, Ill., are now being made with straight holes or perforations in them. These perforations provide clearance to allow the grindings to escape and are provided to prevent an accumulation of ground particles between the face of the grinding disk and the work. Except for the perforations, the grinding member is of the same design as the one described in January, 1932, MACHINERY, page 395.

In the manufacturing process, when the holes or perforations are produced, lateral pressure is exerted on the grains, bringing them closer together in order to provide a denser and stronger structure. The dense structure remains free-cutting, because the grindings have an opportunity to escape and because less cutting points are presented to the work at a time. As the holes extend almost to the steel backing, the clearance lasts until the disk is practically worn out. These perforated disks, when 42 inches or larger in diameter, are made in eight sections. These sizes are used mostly on vertical-spindle grinders.



Besly Titan Grinding Disk with Perforations for Clearance

Grinding Machine for Tungsten-Carbide Tools

A pedestal-type grinding machine designed particularly for sharpening tools tipped with tungsten carbide has been developed by the Tool Metals Co., 439 E. Fort St., Detroit, Mich. This grinder is equipped with two graduated tables that can be tilted up to 30 degrees. Both tables have 4 1/2 inches of horizontal movement through a hand-wheel and a feed-screw. This movement enables the operator to dress the wheel correctly, besides providing a mechanical means of feeding tools to the wheel. Both tables are provided with grooves to guide a diamond dresser across the wheel faces and to receive fixtures that insure accurate grinding of tools.

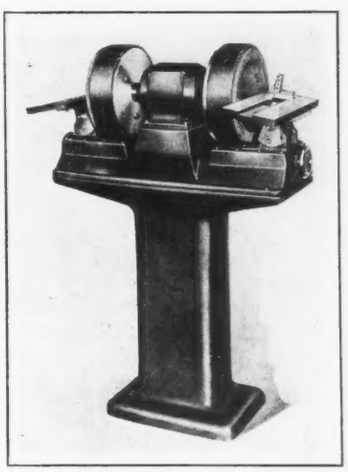
The machine is regularly equipped with two ring-wheels, 12 inches in diameter by 4 inches wide, one for roughing and the other for finishing. If required, a diamond lapping disk 11 inches in diameter can be supplied. The grinding wheels have steel-plate back flanges to permit full use.

* * *

A Cream that Protects Hands from Paint and Grease

Men who work with lacquer, paint, varnish, grease, oil, and similar materials always have difficulty in cleaning their hands. Protection from such materials has been made available by the DeVilbiss Co., Toledo, Ohio, through a new product known as Pro-Tek. This product is a white cream which, when rubbed into the skin before working, forms a protective film that is soluble only in water.

Sticky substances and oily materials cannot penetrate this film, and thus dirt and liquid are prevented from entering the pores of the skin. It is said that the hands can be thoroughly cleaned at the end of a day's work by merely washing them in running water.



Grinder Developed Especially for Tungsten-carbide Tools

MEN IN THE INDUSTRY

W. H. SCOTT has been appointed general sales manager of the Duriron Co., Inc., Dayton, Ohio, succeeding T. D. SLINGMAN, JR., resigned. Mr. Scott has been with the Duriron Co. for thirteen years, having had charge of the Atlanta Division and later of the Philadelphia territory. In 1929, he became sales manager of the industrial department and head of the technical department. He is chairman of a sub-committee of the American Society for Testing Materials on "Sulphuric Acid Submerged Corrosion."

CLAYTON R. BURT, president and general manager of the Pratt & Whitney Co., Hartford, Conn., and a member of the board of directors of the National Machine Tool Builders' Association, has been elected to membership on the board of directors of the American Standards Association. Mr. Burt has had an unusually wide and varied experience in many different manufacturing lines, and his counsel should be of considerable value on the board of the American Standards Association.

J. I. BANASH, consulting engineer, Chicago, Ill., was elected president of the National Safety Council at its twenty-first annual congress at Washington, D. C., early in October. Carl Storck of the Buick Motor Co., Flint, Mich., was elected general chairman of the Executive Committee of the Automotive and Machine Shop Section of the National Safety Council.

NATHANIEL B. WALES, a well-known inventor, has become associated with the G. M. Basford Co., 60 E. 42nd St., New York City, industrial marketing counsellors. He will have charge of engineering and research in the new products development division. Mr. Wales is the inventor of the original Kelvinator refrigerator and many other household appliances.

A. M. BARRETT, for many years prominent in the materials-handling industry, again assumes complete control of the Barrett-Cravens Co., manufacturer of lift trucks, skids, portable elevators, and structural-steel storage racks. The company will move into its own three-story plant at 3255 W. 30th St., Chicago, Ill., which has 75,000 square feet of available floor space.

WILLIAM S. CULVER, district engineer of the East Central District of the General Electric Co., at Cleveland, Ohio, having concluded forty-seven years in the employ of the company and its predecessors, retired from active duty at the end of September. C. W. FICK, assistant district engineer, will succeed Mr. Culver as district engineer.

J. J. DONOVAN, manager of the air-conditioning department of the General Electric Co., Schenectady, N. Y., with headquarters at 120 Broadway, New York City, was elected a director of the American Oil Burner Association at the regular quarterly meeting of the board of directors.

F. J. RUDD has been appointed managing engineer of the motor department of the General Electric Co. at Lynn, Mass. Mr. Rudd succeeds L. E. UNDERWOOD, who has been made manager of the Pittsfield, Mass., works of the company.

RALPH H. ANDERSON, formerly connected with Stedfast & Roulston, Inc., Boston, Mass., is now associated with the Austin-Hastings Co., Inc., ParKett Machinery Division of Boston.

New Books

PLASTIC WORKING OF METALS AND POWER-PRESS OPERATIONS. By E. V. Crane. 326 pages, 6 by 9 inches; 254 illustrations; 25 tables. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $4.

The author of this work has been engaged for many years, as research and design engineer with the E. W. Bliss Co., and, hence, has had the opportunity of obtaining a thoroughly practical background for the preparation of such an exhaustive work on the subject of metal drawing and forming as the book under review. The object of the book has been to sort out the many metal-working operations performed on presses into similar groups, to study their common characteristics, and to establish as complete a working theory as possible for predicting the results obtained from press operations. In these operations, in every case the metal is stressed beyond, and usually far beyond, its elastic limit. Up to the present time, investigators have been concerned mainly with the properties of metals below their elastic limits — metals used for structural purposes. It was, therefore, found necessary to assemble and develop new theoretical data on the properties of metals in what is termed their plastic range. A complete record of this study forms a large part of the present book.

Perhaps the most comprehensive idea of the contents of the work may be formed from a listing of the twelve chapter headings: Mass Production; Essential Metallurgy; Shearing Metal in Dies; the Shearing Group of Press Operations; Bending Operations; Expanding, Contracting, and Curling; Cold-Working of Plastic Metals; the Drawing Group of Press Operations; Drawing Speed, Lubrication, Annealing; Cold Operations of the Squeezing Group; Extrusion; and Hot Press Forging.

The book is one that should commend itself to the thoughtful study of every engineer directly or indirectly engaged in the working of metal in power presses. It has also much to offer to the student of the properties of metals in general.

MECHANICAL CATALOG (1932-1933). 452 pages, 8½ by 11¼ inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

This is the twenty-second annual edition of a reference book containing illustrated catalogue information, conveniently classified, describing the products of manufacturers of mechanical equipment. This edition of the catalogue describes the products of 306 manufacturers. It contains eleven sections dealing with: Power Plant Equipment; Measuring and Testing Apparatus; Power-Transmission Machinery; Materials-Handling Equipment; Metals, Alloys, and other Materials; Foundry, Rolling Mill, and Forge Equipment; Metal-Working Machinery, Machine Tools, and Shop Equipment; Compressors, Blowers, and Pumps; Heating and Ventilating Equipment, Refrigerating Machinery; Specific Industry Machinery, General Industrial Equipment; and Electric Motors and Control. Besides the classified catalogue section and alphabetical index to products, there is an alphabetical index to the firms represented.

Coming Events

DECEMBER 5-9—Annual meeting of the American Society of Mechanical Engineers in the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary.

DECEMBER 5-10—Tenth National Exposition of Power and Mechanical Engineering at the Grand Central Palace, New York City.

JANUARY 7-14—National Automobile Show at the Grand Central Palace, New York.

JANUARY 28-FEBRUARY 4 — National Automobile Show at Chicago, Ill.

NEWS OF THE INDUSTRY

R. Y. Ferner Co., 1127 Investment Bldg., Washington, D. C., American representative of the Société Genevoise d' Instruments de Physique, of Geneva, Switzerland, has appointed H. S. Huncke & Co., 27 S. Jefferson St., Chicago, Ill., agent for the sale of the Société Genevoise's measuring equipment and portable hardness testing instruments, as well as a line of dilatometers, and thermal analyzers made by the Acieries d' Imphy in France. Neff Kohlbusch & Bissell, 2400 W. Madison St., Chicago, will continue to handle the sale of the Swiss jig borers as well as precision screw-cutting lathes and dividing machines. G. Robert Osgood, 128 Dexter St., Malden, Mass., will handle the sales of hardness testing instruments and dilatometers in New England.

Keystone Lubricating Co., whose plant at 21st, Clearfield, and Lippincott Sts., Philadelphia, Pa., was burned to the ground on October 3, announces that two days after the fire a contract was signed to rebuild on the same foundations a building with every modern improvement, equipped with the latest types of machines. The rebuilding of the plant will be started immediately. During construction, the temporary offices of the company are in the building of the Steel Heddle Mfg. Co., 21st St. and Allegheny Ave.

Marlin-Rockwell Corporation, Jamestown, N. Y., announces that it has consolidated the sales activities of its three subsidiaries—the Gurney Ball Bearing Division, Standard Steel & Bearings, Inc., and the Strom Bearings Co. The bearings manufactured by all these companies will be available through the corporation's sales organization with offices at 402 Chandler St., Jamestown, N. Y.; Woodford Ave., Plainville, Conn.; and 2526 S. Michigan Ave., Chicago, Ill.

Carboloy Co., Inc., 2481 E. Grand Blvd., Detroit, Mich., has announced a new plan known as the "Milled and Brazed Service," for reducing the cost of Carboloy cemented-carbide metal-cutting tools to users. Milled and brazed Carboloy tools are the same as the regular line of finished tools, except that they require a small amount of grinding before being put into operation. Descriptive literature on this cost-saving plan is available.

Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa., has concluded a manufacturing agreement with the Torrington Mfg. Co., whereby the machines and instruments made by the Riehle Bros. Testing Machine Co. will be built by the Torrington Mfg. Co. at its plant in Torrington, Conn. The former company will retain its corporate identity and will continue to conduct its engineering and sales.

Pyroil Co., 112 LaFollette Ave., La-Crosse, Wis., has adopted a new label design for its lubricants. The new design incorporates the use of three colors —one for motor and machinery top oil, which has a yellow motif; one for motor and machinery base oil, which has a green motif; and one for winter grade motor and machinery base oil, which has a gray motif.

Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has appointed J. L. Kilroy, 114 Bauer Ave., Louisville, Ky., representative for the IXL products in the state of Kentucky and part of Indiana and Ohio. C. H. Taylor, Johnston Bldg., Charlotte, N. C., has been appointed representative in South Carolina and part of North Carolina.

Sommer & Adams Co., Cleveland, Ohio, announces that Frank E. Artz, 2136 N. Newland Ave., Chicago, Ill., has been appointed exclusive representative in the Chicago district to handle the Sommer & Adams line of automatic polishing and buffing machines, and continuous milling and drilling machines.

Dreis & Krump Mfg. Co., 74th St. and Loomis Blvd., Chicago, Ill., has appointed the ParKett Machinery Division of the Austin-Hastings Co., Inc., Cambridge, Mass., exclusive distributor for the company's line of Chicago steel power brakes, power presses, and power shears in the New England states, with the exception of Connecticut.

Thomson-Gibb Electric Welding Co., Lynn, Mass., is engaging in the manufacture of a new complete line of wire-mill and stranding machinery. A. R. Petterson, formerly chief engineer for the New England Wire Machinery Co., will have charge of the sales and engineering work.

Sidney Machine Tool Co., Sidney, Ohio, has appointed the Austin-Hastings Co., Inc., ParKett Machinery Division, Cambridge, Mass., exclusive agent for the complete line of Tritrol and Monotrol lathes in the New England territory.

Engineer's Specialty Co., 549 W. Randolph St., Chicago, Ill., has purchased the manufacturing rights to the Columbia one-way free-wheeling clutch formerly made by the Columbia Industrial Machinery Co.

Obituaries

William Booth Gammons, president of the Gammons-Holman Co., Manchester, Conn., died suddenly October 2 at his home in Manchester. Mr. Gammons was born in South Norwalk, Conn., May 17, 1872. When he was sixteen years old he went to Hartford, where he served an apprenticeship for the machinists' trade with the Pratt & Whitney Co. and the Fenn Mfg. Co. Subsequently he followed his trade at the Colt Fire Arms Mfg. Co. and the Pratt & Whitney Co. In 1918 he established his own factory in Manchester to manufacture the Gammons helical taper pin reamer. In 1920, the Gammons-Holman Co. was formed.

Mr. Gammons was widely known for his inventions. The Gammons helical taper pin reamer perfected in 1917 was his most outstanding invention and is now the principal product of the Gammons-Holman Co. Mr. Gammons also invented a broaching machine, the Gammons helical chucking reamer, and the Parob expansion reamer.

Adolph Lomb, vice-president of the Bausch & Lomb Optical Co., Rochester, N. Y., died at his home in Pittsford, N. Y. (a suburb of Rochester) on September 30, following a brief illness.

Mr. Lomb, the eldest son of Captain Henry Lomb, one of the founders of the Bausch & Lomb Optical Co., had been connected with the company for fifty-three years. He entered the organization when he was fourteen years old, and was associated with it continuously from that time on, except for a temporary absence during which he went to college.

Mr. Lomb was born in Rochester in 1866. He was a graduate of the University of Rochester, and had also taken advanced work at the Massachusetts Institute of Technology and the University of Berlin, Germany. Besides being connected with the Bausch & Lomb company, he was identified with a number of scientific societies, chief among which was the Optical Society of America, of which he was treasurer from its inception.

Tinius Olsen, pioneer in the development of testing machinery in the United States, died at Mount Airy, Pa., October 20. Mr. Olsen was the founder, and until several years ago president, of the Tinius Olsen Testing Machine Co., of which his son is now president. A more complete account of Mr. Olsen's life and achievements will be published in December Machinery.

Clarence E. Fowler, who was manager of the branch sales office of the Independent Pneumatic Tool Co., in Toronto, Ontario, Canada, for a number of years, was mortally wounded while hunting and passed away on the morning of October 15.

Classified Contents of this Number

Design, Fixture and Tool

Large Draw-in Chuck with Interchangeable Jaws—*By M. Jacker* 205
Attachments for Vernier Caliper—*By William C. Betz* 205
Gage for Duplicating Tapers—*By Peter L. Budwitz* 208

Design, Machine

Mechanism that Returns Lever to its Starting Position when Machine is Stopped—*By F. R. Zimmerman* 179
Intermittent Movement of Reciprocating Slide—*By J. E. Fenno* 179
Mechanical Device Stops Press if Punch Breaks—*By H. R. Hageman* 181
Manufacturing Equipment to Meet the Needs of the Designer 214

Diemaking, Die Design, and Press Work

How the Pantograph Aids the Diemaker 166
Power Presses Offer New Possibilities in Production Work 189
Forming and Folding Die for Paper Boxes—*By H. R. Schmidt* 206
Cutting-off Die Designed to Facilitate Resharpening—*By F. E. Wertheim* 207

Management Problems

New Pathways Suggested for Industry 175
Industry's Stake in the Tariff and Debt Situation 178
The New Problems of a New Era Require New Solutions 178
How to Crate Machinery to Prevent Damage in Transit—*By John G. Davies* 202
A Novel Method of Reducing Accidents 208
Suggestions for Inter-industry Planning—*By L. M. Waite* 215

Materials, Metals, and Alloys

Stainless Steel is Well Adapted to Spot-welding .. 165
Forty-three Die-castings Used in Construction of New Lathe 212
The Alumilite Process 217

Meetings and Expositions

American Society of Mechanical Engineers Elects A. A. Potter President 204
New Products Conference Held in Cleveland 204
Many Shop Problems Discussed at Buffalo Meeting 209
Machine Tool Builders Discuss Pressing Problems of the Industry 213

Railway Shop Practice

Ball-bearing Lathe Center for Reclaiming Air-pump Pistons and Rods—*By Edwin G. Jones* ... 170
Air Cylinders in Floor Facilitate Handling Truck-wheel Sets 170

Shop Practice, General

A High-grade Paint Job Calls for Close Attention to Details—*By Frank W. Curtis* 161
Selecting the Right Cutting Tools in a Modern Machine Shop—*By J. M. Highducheck* 172
A Huge German Milling Machine 177
Speeds and Feeds Cannot Be Easily Standardized. 178
Advances in Grinding Machines to Meet the New Needs of Industry 182
Some of the Results Achieved by Automatic Polishing Methods 194
New Developments in Blueprinting Practice 196
Gear-cutting Machines of Recent Design Have Speeded up Production 197
Power Consumed by Self-opening Die-heads—*By C. W. Bettcher* 210
The Smallest Complete Ball Bearing Ever Made .. 217
Shop Equipment News 219

Do You Know

how much power is required for cutting threads with self-opening die-heads?—see page 210.

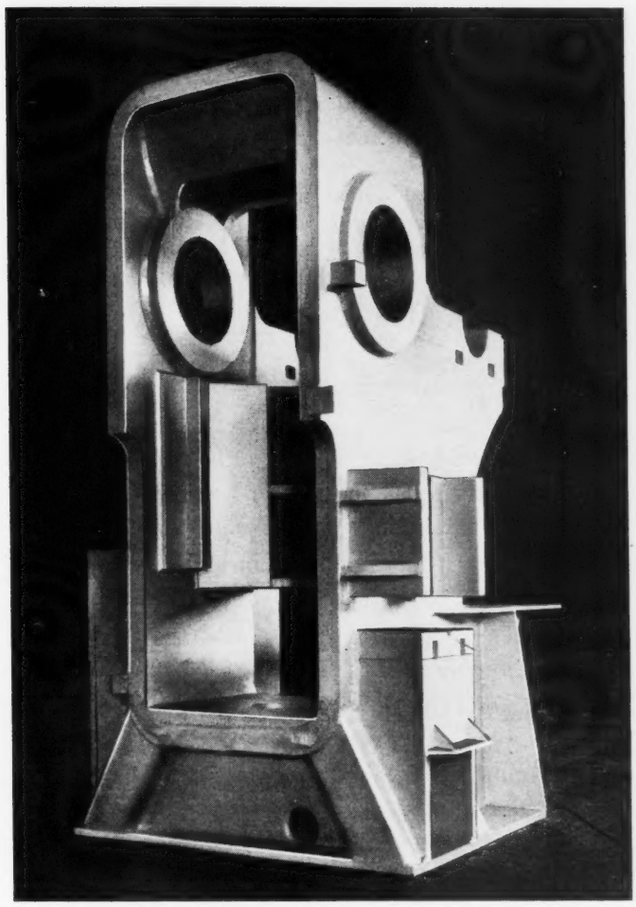
what is the smallest complete ball bearing manufactured for the market?—see page 217.

that forty-three die-castings are being used with satisfactory results in the construction of an engine lathe?—see page 212.

what the Alumilite Process is and what it is used for?—see page 217.

MACHINERY

Volume 39 NEW YORK, DECEMBER, 1932 Number 4



Arc Welding Introduces New Methods in Machine Design

By EVERETT CHAPMAN
Director of Development and Research
Lukenweld, Inc., Coatesville, Pa.

Economical Production of a Frame for a 500-Ton Precision Press by a Unique Method of Determining Stresses and the Use of Welding

IN order that welded constructions may be economical in first cost and render satisfactory service, the design must be made by one who is thoroughly familiar with welding processes.

The first question to be considered is the analysis of the working stresses in the various sections. When it is known where dangerous concentrations in stresses will occur, steps may be taken to avoid them or to provide ample strength to resist them. How this can most readily be done by welded construction will be indicated by considering the detailed design of a heavy forging press. It will then be shown that the resulting stresses and deflections

in the completed machine are exactly as predicted, and are attained at a first cost which is well within that of a conventional machine of similar type.

New Designs Required for Arc-Welded Construction

There is not much sense in imitating the design of a casting with welded bits of plate, angle-iron, and I-beams. The casting has been designed for the casting process. To attempt to duplicate it by welding is to miss an opportunity to progress.

If a cast-iron piece—frame, bedplate, etc.—is duplicated in welded steel, web for web, but using thinner sections, it will be found that much weight will be saved and the new part may also be cheaper, but it will probably lack torsional stiffness and it may have vibration periods that will give trouble when in use. A conventional design should not be slavishly copied in a different metal fabricated by a different process.

The arc-welding process has changed the entire relationship between designer and constructor. Formerly the principal question was "How can you put the metal where I want it?" And if the answer was "I can't," then the designer worked out something that would serve and could be built. Now the designer's chief problem is to find out exactly where he wants the metal and how much of it he needs.

This new problem of design is not simple. Machine design is not nearly so determinate, from a mathematical standpoint, as structural design, for instance. Riveted joints have little strength except in shear; therefore, beams and girders are properly assumed to be "pin-connected" at the ends, which assumption greatly simplifies the computations. But the situation faced by the designer of, say, a welded forging press, is entirely different from the simplified conditions assumed by the structural designer. The loads depend not only upon the movements of the gearing, shafting, and pitman, but also upon the stiffness of the metal forming the main frame, its crown, bed, and side columns. The bed is one or more hollow boxes, and the stress distribution is extremely complex. All joints must be considered to have fixed ends, for the junctions of plate, web, and diaphragm are of continuous weld metal.

Celluloid Models for Determining Complex Stresses in Press Frame

Models of these machine structures, giving the action of the whole construction as an elastic unit, must be studied if the engineer is to produce a really economical design. Otherwise, he will draw up machinery by rule of thumb; it will be the product of an artisan rather than of an engineer. When he takes transparent celluloid, cuts from it a model to scale, loads this model at proper places with appropriate weights, and exposes the model to polarized light, the distribution of the internal stresses is shown by colored interference bands in the celluloid. These markings spread apart in the broad reaches where the stress is low and uniform, but concentrate at corners and at notches, where dangerous stresses exist.

The amount of stress at any place can be computed by pulling a plain tension test bar of celluloid in an appropriate fixture until the colored interference effects in the two pieces cancel each other. Only the cross-section and loads on the tension bar need be measured to determine the unit stress.

Models of this sort have been extensively used by civil engineers to study the design of arched bridges, dams, and other monolithic concrete structures. The method enables one to discover the places

Before the introduction of welded construction, the main problem was to so design machine parts that they could be readily cast and would be sufficiently strong at their weakest points to withstand the imposed stresses. With arc-welded construction, the problem is to find out exactly where the metal is wanted and how much is needed to give the necessary strength and rigidity without excess weight. How this is accomplished by celluloid models exposed to polarized light is described in this article. The actual construction then becomes a relatively simple problem, as arc welding provides a practical and economical means of placing the metal exactly where it is required. — The article is based on a paper that was awarded one of the prizes in the second Lincoln arc-welding prize competition sponsored by the Lincoln Electric Co., Cleveland, Ohio. It is expected that several of the prize-winning papers in the competition will be available in book form at a later date.

where stresses are high; to predict the starting point of fatigue cracks; and to modify the design so as to throw the stresses below the endurance limit for the material to be used.

Redesigning C-Frame Punch Press

The celluloid-model method has been used for some time by the Lukenweld company in making commercial designs. One of its early applications was in the redesign of a C-frame punch press. These frames have a habit of cracking through a re-entrant curve just behind the lower platen, a curve placed there for convenience in machining. No wonder they break there. The stresses at this point near the surface are twelve times as great as the average stress across the back of the frame. Metal at this re-entrant curve works well beyond its fatigue limit at every stroke of the press; it is not surprising that the frame breaks at some unexpected moment. Its action is unpredictable; some frames break after a few months, others may last years.

A simple change in the contour adopted for welded-plate construction eliminated this danger zone and reduced the maximum concentrated stress to one-quarter that present in the old design. A mere redistribution of metal—putting it where it is needed to carry the loads rather than where it will convenience the foundryman and machinist—has made a press that can operate 60 per cent above its rated capacity and still be immune from fatigue fracture.

Enough proof-testing of completed machinery has been done to substantiate thoroughly the indications of scale models. For instance, when the first C-frame press was completed, it was loaded with powerful jacks. The strains in the metal at critical areas were measured by Huggenberger extensometers, and the internal stresses causing these deformations figured from the modulus of elasticity. The stresses in the frame predicted by the model studies were verified completely. It is believed that this represents the first time a machine tool has been built in which the stresses during operation were accurately predicted during the design.

Enough has probably been said to demonstrate that welded construction with accurately predictable performance demands a return to fundamental considerations of design. It has also been suggested that an analysis of the stresses in a complex mechanism may be made with relatively simple equipment. A correct analysis of this sort is a prime requisite. Without it, the economies inherent in welded construction may not be attained.

Fig. 1. First Design of 500-ton Arc-welded Steel Press Frame Copied from a 100-ton Press of Cast-steel Construction

Designing a 500-Ton Forging Press

The methods outlined have also been applied to the design and manufacture of a forging press of 500-ton capacity capable of making "precision forgings." This matter of precision in heavy presses is forcing many manufacturers to redesign their lines. Up-to-date manufacturing programs require the production of stampings and forgings in quantity to limits hitherto unknown. It is not infrequent that a set of dies costing $10,000 is mounted in a press costing $2000. Such dies must not be exposed to damage by a loosely operating press, nor can work be produced to close tolerances in such a machine, even in the most precise dies, unless the press mechanism has a minimum range of elastic movement.

The cost of the die per piece produced depends upon the number of times it can be ground and the number of satisfactory pieces it makes before it needs redressing. The latter, in turn, depends upon the rate of wear, and this varies almost directly with the amount of angular distortion in the frame and moving parts of the press. Hence, there is great need of precision in forging and stamping machinery.

For such reasons as these, when a prospective purchaser of a 500-ton precision forging press considered its design, he came to the conclusion that the conventional equipment on the market would not serve his purpose. It might be characterized as a composite construction where rigidity is secured only by a tremendous excess of metal. In essentials, such a frame is illustrated in Fig. 1. This press frame is copied from the design of a 100-ton press frame of cast-steel construction, and consists of a crown, a bed, and two side columns tied together with heavy bolts. Its deficiencies will be discussed in what follows.

From the start it was obvious that the 500-ton press must be made of steel. It was anticipated

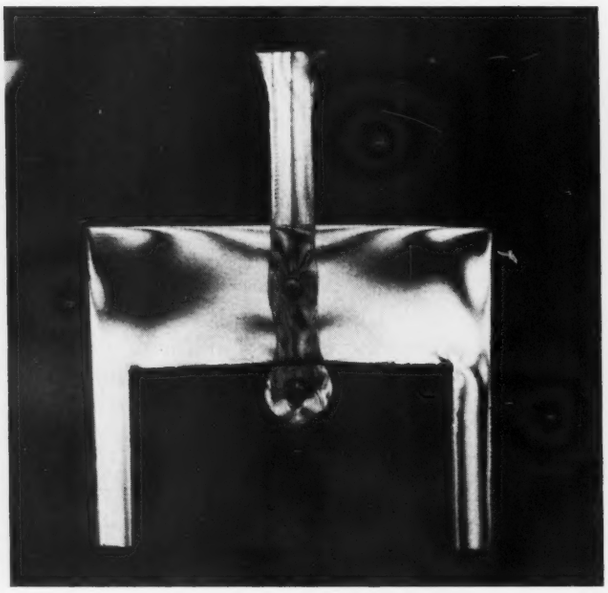


Fig. 2. Transparent Test Model of Yoke of Press Frame Shown in Fig. 1, Indicating Large Concentrations of Stresses

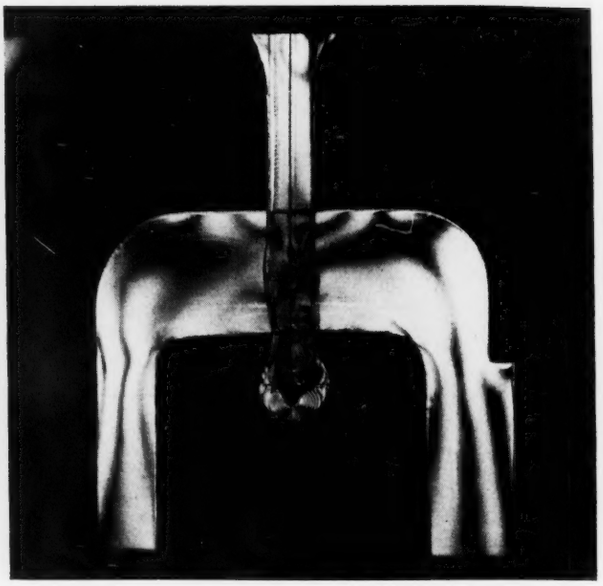


Fig. 3. Celluloid Test Model of Yoke of Redesigned Frame, Showing Absence of Stress Concentrations at Rounded Corners

that the main frame, if a casting, would weigh about 70,000 pounds and would tax the capacity of railroad cars, available machine tools, and the best foundry. Side sections about 20 inches thick would be very difficult to cast without internal porosity. Briefly, the action of the press could not be predicted with certainty.

Precision, one of the requirements of the products from this large forging press, required rigidity in the press—that is to say, a minimum of deflection. It made undesirable a composite construction of four principal parts held together by tie-rods. Welded steel plate appeared to meet the requirements.

As a first step, transparent celluloid models of the crown and base for the 500-ton press were made, loaded on the center line, and studied under polarized light. Figs. 2 and 4 show these models as photographed under stress. It was at once apparent that there was a large concentration of stress at the square corners where the crown and bed joined the upright columns.

Fig. 4. Model of Conventional Design of Press Base, Indicating Dangerous Concentration of Stresses at Square Corners

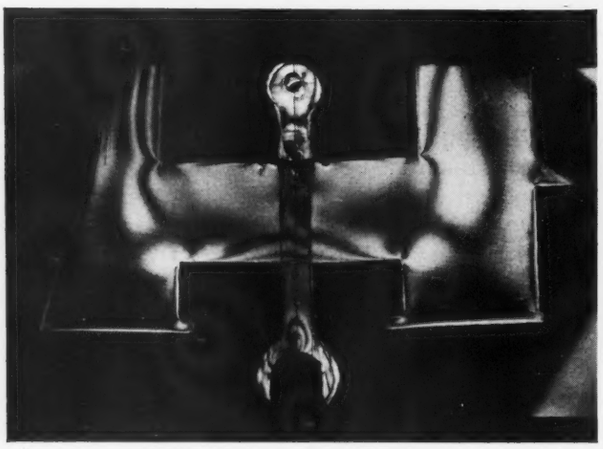
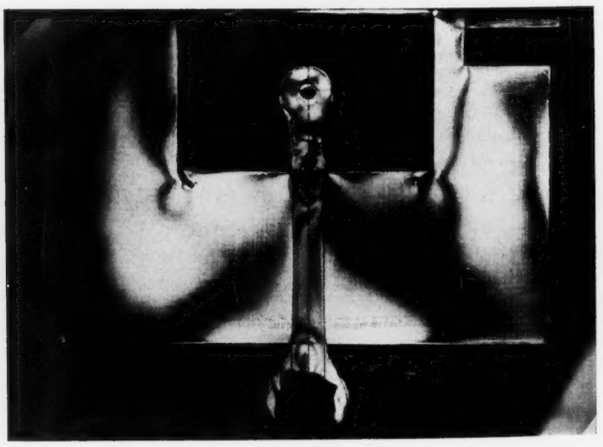


Fig. 5. Model with Radius Saw-cuts at Corners to Simulate Base with Filler Piece Welded at the Front and Rear Edges



It took but little further study to show that the conventional design for the bed was inadequate. As an alternative, a box section was considered, relatively simple to construct and much more economical in the distribution of metal in a member subjected to bending. The amount of steel was reduced by 13 per cent, yet the new design is four times as stiff and involves stresses that are less than half those encountered in the old design.

The 4 1/2-inch slab that formed the top of the bed design was turned up vertically on the ends to form the side frames and met at the top for the crown. This design has several advantages. In the first place, only two welded joints are necessary—one at the center of the base and one at the center of the top. These welds are placed where they can be adequately reinforced with diaphragms and where the bending stresses in service theoretically approach zero. Hence there are only shearing stresses at these welds.

Furthermore, a relatively cheap bending operation forms the corner joints—much cheaper than welding—and at these critical corners the wide sweep of the curve prevents the dangerous stress concentrations of conventional designs. The tie-rod construction of old was thus superseded by a beautifully simple design shown in the heading illustration and Fig. 6.

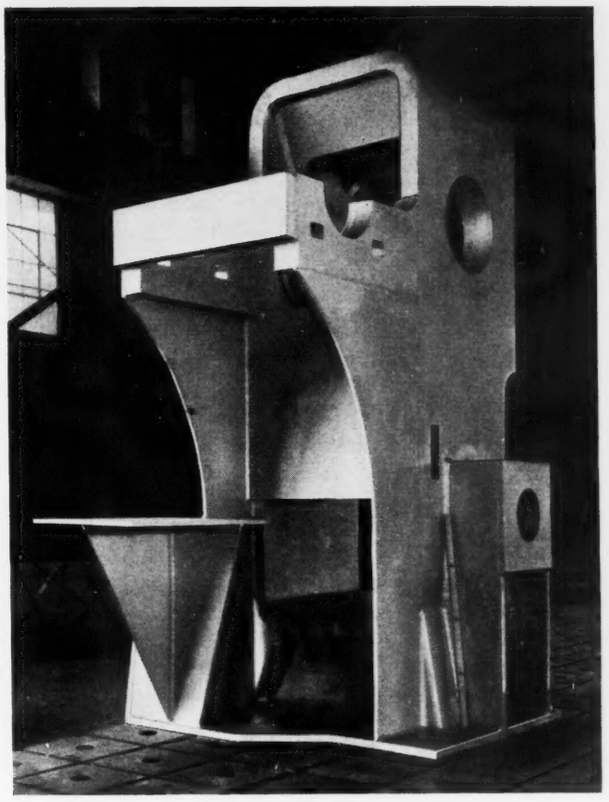


Fig. 6. Rear View of 500-ton Arc-welded Press Frame Shown in the Heading Illustration

Loads are imposed on this frame through the two main bearings, the reaction there being in a more or less vertical direction upward. Equal reaction is absorbed vertically downward by the bed and delivered half-and-half to the lower end of the side frame. When a celluloid model of this new design was cut and exposed to polarized light, the stress distribution was found to be far more satisfactory. Compare Figs. 3 and 5 with Figs. 2 and 4, respectively. Stress concentrations are notably absent in the two former cases.

A word of explanation is necessary about the saw-cut appearing in the model of the base, Fig. 5. Reference to the photographs of the completed frame will show that a 2 3/4-inch slab of steel with beveled edges forms an over-lay above the 4 1/2-inch slab of the main frame. This is put there in order to build up the bed flat and to full width between the side verticals, so that the radius of the bends at the lower corners will not restrict the clear press opening.

This filler slab is welded only at its front and rear edges. There will be a very small notch effect due to the lack of bond with the side frame, and an effort was made in the model to simulate this notch effect by the saw-cuts. Undoubtedly, the model magnifies the stress disturbance at this point enormously, but even so, the interference bands show that a very moderate concentration exists there. This filler slab is so loosely held that it should be disregarded.

A few figures will indicate how these changes in the proposed design affected the rigidity of the press—a most important consideration, for it determines the precision that may be expected in the forgings made in it. At the full 500-ton load, the stretch in the side frame is 0.008 inch, and the deflection in the bed 0.021 inch, making a total of 0.029 inch for the first design shown in Fig. 1. For the revised design, the stretch in the side frame is 0.008 inch and the deflection in the bed, 0.004 inch, making a total deflection of 0.012 inch.

It will be seen that the total movement in the frame in the revised design is much less than the 1/64 inch desired and specified, whereas the elastic changes in the frame, as first proposed, were about 1/32 inch.

Another feature of the revised design—easily incorporated by welding, but adding to the difficulties of casting—is the method of restraining the "spring" in the side frames. It was computed, and verified by photo-elastic studies, that in the design shown in Fig. 1, the guides directing the movement of the upper die would spring together not less than 0.012 inch when the press operated at full loading. Obviously, movements of this magnitude should be prevented.

The illustrations of the new press show how the necessary rigidity was provided. The 2-inch plates forming the front and rear supports of the bed

were extended sidewise and up beside the side columns. That is to say, these plates were cut into a U-shape, and hug the entire bottom of the frame. This construction has several additional advantages: It widens out the structure like a pyramid toward the base, giving it an air of stability which it truly possesses; also, the tops of the U form good foundations for an outboard bearing on one side and the trimming shear on the other.

Further and greater restraint to springing in the side columns is provided by three horizontal plates welded across the rear of the frame, reinforced by a vertical back-plate, this reinforcing unit having an E-shaped cross-section. It is placed as a direct strut to absorb any forces that would cause the guides to change their spacing. By these expedients the side spring tending to cramp the guides and throw the main bearings out of alignment has been cut to a minimum—certainly to about 0.001 inch.

Method of Reinforcing Crown of Press Frame

A final noteworthy feature of this press frame must suffice for its description. This is the reinforcement at the crown. It is obvious that the reactions imposed by the crank, as it forces the upper die down upon the work, are not exactly vertical, except at dead center. Heavy stresses occur as soon as metal-to-metal contact is made, and these stresses are inclined at a considerable angle to the vertical. Hence, it is obvious that the bracing across the top, which spreads out the reactions from the bearings, should be inclined fore and aft as well as vertically.

The heading illustration and Fig. 6 show that this has been done—it can be done with the greatest ease when the arc-welding process is used for fabrication. This huge welded unit weighs approximately 40,000 pounds complete. The heaviest slabs are 4 1/2 inches thick and form the main frame. The over-all dimensions are 12 feet 10 inches high, 6 feet 8 inches wide, and 9 feet 4 inches deep.

Economy of Welded Construction

The relative economies attained by welded construction of the 500-ton press may be indicated rather than definitely computed, for, as already shown, desirable and predictable results have been achieved in this design which are probably beyond the capacity of any other construction method. As an indication of how these economies mount, consider the driving mechanism of such a unit as this.

The conventional method of making the flywheel is to construct it of cast iron. It is a simple wheel, heavy enough to store the energy necessary to carry the pitman and crank over dead center. Cast iron, however, is not very strong in tension, so that the speed of rotation and the induced centrifugal stresses must be held down. A flywheel of about half the weight can be cut directly out of a thick slab of rolled steel, and it can safely operate at twice the velocity, thus storing the same amount of energy as a cast-iron flywheel.

This means that the whole drive can be correspondingly reduced. The motor is more economical; one developing the required horsepower but operating at twice the speed costs only about half as much. All shafting, bearings, and intermediate gears are proportionately smaller. The clutch, which develops trouble in many presses, represents another advantage; it now has to carry but half the torque, and clutch trouble varies directly with the torque.

Such economies as stated have been achieved at every turn in this design in addition to those easily demonstrable for the main frame. Observe the following comparison of costs, welded steel versus cast steel: The weight of the welded steel frame is 40,000 pounds, as compared with 70,000 pounds for the steel casting. The total cost of the welded steel frame, including machining, was $2900, and of the steel casting, $5550. The delivery time on the welded steel-plate job was two weeks.

The new design operates with closer clearances and is able to make forgings with far better tolerances than the first welded design, and closer than anything that could be produced by conventional construction of cast units tied together with heavy bolts, without putting into the frame an excessive amount of metal.

To summarize: When welded constructions are designed with a clear understanding of the stresses and deflections, and produced under controlled shop conditions, the results will show economies in weight and first cost and satisfaction in service.

* * *

The Note-Book Habit Develops Mechanical and Engineering Ability

By WILLIAM R. HOWELL

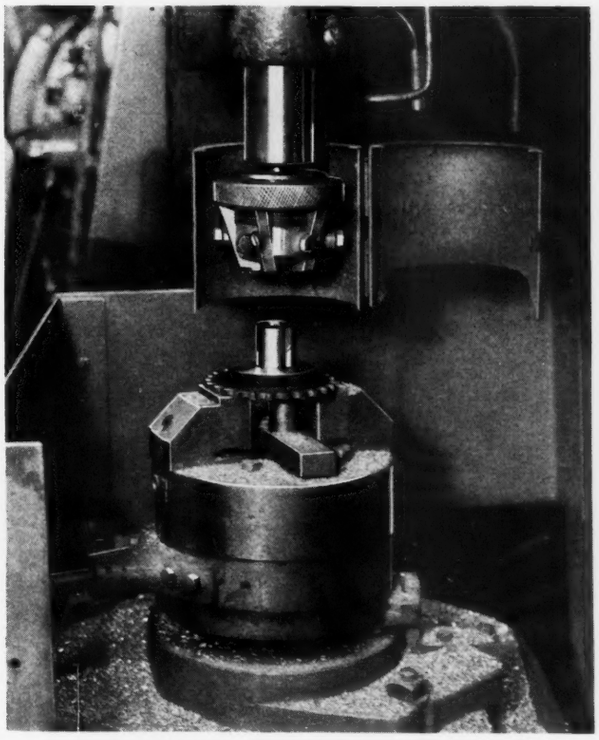
The suggestions on page 46 of September MACHINERY regarding the keeping of a note-book containing information on everything that may later be of use to the mechanic are well worth following. The writer has found notes kept in this manner to be very valuable, especially those pertaining to processes or production methods.

The following suggestions on keeping such a note-book will be found helpful: The information should be indexed or entries will soon become confusing; the material indexed should be classified according to the source of information, as it is generally easier to remember the source of information than the information itself.

The drafting-room, machine shop, foundry, accounting department, etc., should have divisions of their own, as well as any departments peculiar to the company, such as the color shop of a textile printing company. Clippings and tables are best kept by themselves. Regarding the actual entries, it is advisable to leave a wide margin on the left-hand side of the page and in this margin print the title of the entry so that the contents can be quickly noted. A loose-leaf book is by far the best.

Long Life of Tungsten-Carbide Tools in Machining Automobile Parts

TUNGSTEN-CARBIDE tools are being used for machining cast iron, bronze, and aluminum alloys at the plant of the Hudson Motor Car Co., Detroit, Mich., with highly satisfactory results. The most outstanding application is in the piston department, where cutters made from this superhard material are employed for practically every operation, with the exception of a grinding and a diamond boring operation. Without tungsten carbide, it would be impossible to machine, on a production basis, the high-silicon aluminum alloy from which the pistons are made. September MACHINERY contained an article describing the use of tungsten-carbide tools in the piston department; the present article will discuss typical applications in other departments of the same plant.



Before the development of tungsten carbide, considerable difficulty was experienced in chamfering the bottom of the bores in the cast-iron cylinder blocks. A production of only 100 pieces was obtained for each grind of the chamfering tools, whereas 5000 pieces per grind are now obtained with tungsten-carbide cutters. The total number of pieces obtained per life of the former tools was 34,000, whereas the life of the tungsten-carbide tools is about 264,000 pieces. The tungsten-carbide tools cost $18 apiece, as against $6 for the tools previously used. Thus, each time that a tungsten-carbide tool of a given set-up is worn out, a saving in tool cost of about $27 has been effected. This job is performed on a Moline multiple-spindle drilling machine.

Considerable trouble and expense were also experienced in an operation on cast-iron clutch covers before tungsten-carbide tools were available. This operation consists of finish-turning the rabbet diameter and finish-facing the flange, four lugs, and eight bosses. It is performed in a Sundstrand stub lathe.

With a production of 60 pieces an hour, about 400 pieces were obtained per grind with the tools formerly used, and they lasted for approximately 30,000 pieces. The tungsten-carbide cutters now used at the same rate of production are reground only about every 5500 pieces, and they have a total life of approximately 200,000 pieces. The tungsten-carbide tools cost $36, as against $12 for the former tools. Thus, with an initial cost three times as much as before, the life of the tools has been increased almost seven times.

Cast-iron flywheels are machined on the clutch side and on the rim in Bullard six-spindle Mult-Au-Matics. Twenty-eight tools of various shapes are used on each machine. With the tools previously used, each machine produced 30 flywheels an hour. The tools had to be reground every 300 pieces and had an approximate life of 18,000 pieces.

Tungsten-carbide tools have been applied to this operation, and as a result, production has been speeded up to 60 flywheels an hour. This enabled two machines and two operators to be eliminated. Additional advantages have been derived from the fact that the tungsten-carbide tools need only be reground every 800 to 1000 pieces, and they have more than three times the life of the tools previously employed. The tungsten-carbide set-up cost $500, as compared with $155 for the former tools.

Tungsten Carbide Gives a More Accurate Finish on Bronze Castings

The illustration shows a hollow-mill being used for turning the hub of a bronze casting. This material is unusually tough and there is considerable sand on the outside of the part. The operation is the first one performed on the casting, and it is especially important because the part is located from the hub for later operations. In this example, the tungsten-carbide tipped blades were adopted with the view of obtaining a better finish and of

turning the hub round within close limits of accuracy.

The production with both the old and new tools has been 225 pieces an hour. The cutter blades previously used gave a production of about 400 pieces per grind and the life of the tool was about 25,000 pieces, the initial cost being $10.

With a tungsten-carbide cutter, 5800 pieces are averaged per grind and the estimated life of the tool is 500,000 pieces. This tool cost $36. Thus the saving in initial tool cost based on the estimated life of the tungsten-carbide tool, will be $174, not to mention the economies effected by the fewer regrindings.

Tungsten-Carbide Tools Used for Boring and Reaming the Aluminum Transmission Case

Tungsten-carbide tools are employed for boring the front and rear main bearings of the aluminum-alloy transmission case and for drilling the idler and countershaft holes. The operation is performed in a two-way horizontal boring machine. In taking these cuts, the tools produce about 4000 pieces per grind.

A tool tipped with tungsten carbide is also employed for line-reaming the idler and countershaft holes in an upright drilling machine. In a test run conducted with this tool and one of the type previously used, the rate of production being the same, the tungsten-carbide tool gave a production of 2000 pieces per grind, as against 400 pieces for the tool formerly used. The total number of pieces per life of the tool was 84,000 for the tungsten-carbide cutter, as against 7200 for the previous tool.

* * *

Micarta Bearings for Rolling Mills

Micarta has given remarkable results in numerous mechanical applications involving severe service. One of the most recent and notably successful applications of this material is found in rolling mill equipment. Roll-neck bearings with Micarta linings, such as shown in Fig. 2, are now being used successfully on wire, rod, bar, and merchant mills. The Westinghouse Electric & Mfg. Co., who developed these bearings, is now conducting experiments with a view to equipping larger mills with similar bearings.

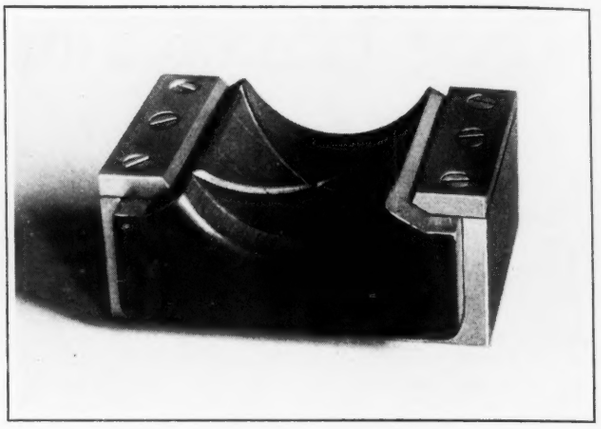


Fig. 2. Bearing with Micarta Lining Used for Rolling-mill Service

The Micarta lining of the bearing shown in Fig. 2 is made up of several pieces, as shown in Fig. 1. This lining of laminated material has long wearing qualities and eliminates the danger of "seizing" and "grabbing." Instead of scoring the shaft, it gives it a polish. Shocks and blows that damage and fatigue ordinary linings are said to have little or no effect on this material.

Water alone is used as a lubricant, and tests indicate that power savings as high as 30 per cent may be expected by the application of these bearings. It is estimated that the life of these bearings will be from four to ten times that of ordinary bearings.

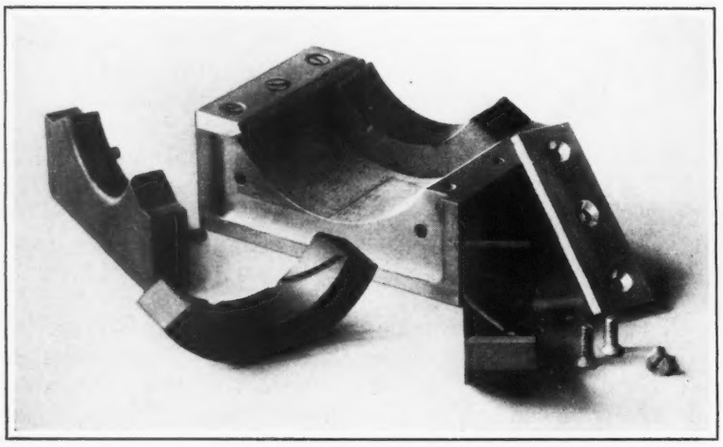


Fig. 1. Parts of Roll-neck Bearing Illustrated in Fig. 2

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Extravagance of Using Old Equipment

A certain company had been postponing from year to year the installation of new steam boilers. They fondly cherished the belief that they were saving money by so doing. But finally they bought new boilers. The following autumn they put in the usual supply of coal for the winter. The next spring, the head of the company observed, to his amazement, that the coal pile was still of very healthy proportions. Investigation disclosed that the new boilers had used only half as much coal as the old ones, which had been disgracefully wasteful and inefficient. This company had actually been paying for the new boilers once every two years in extra, needless coal bills—but had nothing whatever to show for it until they signed the order for the new equipment.

—Dr. Julius Klein, Assistant Secretary of Commerce

WIRE AND SHEET-METAL GAGE APPLICATIONS—1

Name of Gage	Gage Application
American or Brown & Sharpe Wire Gage	Used for bare wire of brass, copper (except bare copper telephone wire), phosphor-bronze, German silver, aluminum, and zinc, and for insulated wire of aluminum and copper; for rods of non-ferrous metals, such as brass, copper, and aluminum. Also used for sheets of brass, copper, aluminum, phosphor-bronze, German silver; used for wall thickness of brazed (not seamless) brass and copper tubing.
U. S. Standard Gage—a Weight Gage Based on Weights in Ounces per Square Foot	Used for all uncoated sheet and plate iron and steel, including hot- and cold-rolled steel; also used for hot- and cold-rolled Monel metal.
Steel Wire Gage—Also Known as Washburn & Moen, American Steel & Wire Co., and Roebling Wire Gage	Used for bare wire of galvanized and annealed steel and iron (except telephone and telegraph) and also for spring steel wire.
Birmingham or Stubs Iron Wire Gage	Used for wall thickness of seamless tubing of brass, copper, bronze, steel, and aluminum; strip steel, spring sheet steel, saw steel; sometimes applied to flat rolled steel; generally used for iron and steel telephone and telegraph wire. This gage is being superseded by American wire gage.
Birmingham Gage (B.G.) This 1914 Birmingham gage differs from the older Birmingham or Stubs iron wire gage.	British legal standard for iron and steel sheets and hoops. The initial letters B.G. should be used in specifications to distinguish this iron and steel sheet and hoop gage from other gages.
Stubs Steel Wire Gage	Used for cold-drawn tool-steel rods and wire and by some manufacturers for drill rods.

MACHINERY'S Data Sheet No. 239, New Series, December, 1932

WIRE AND SHEET-METAL GAGE APPLICATIONS—2

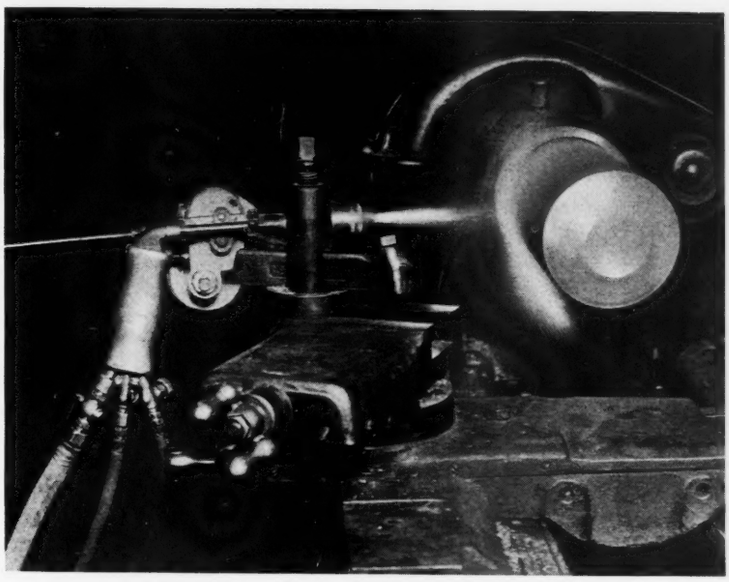
Name of Gage	Gage Application
Twist Drill and Steel Wire Gage	Generally used in the United States for drill rod or twist drills made to wire gage sizes.
Imperial Standard Wire Gage (S.W.G.)	The standard in Great Britain and Canada for all wires; also customary standard for non-ferrous sheets; sometimes used for iron and steel sheets.
Galvanized Sheet Gage—Based on Weight per Square Foot	Customary gage in the United States for galvanized sheets of steel or iron.
Tin-plate Gage—a Weight Gage Based on Pounds per "Base-box"	Used for tin plate (sheet steel coated with tin) and roofing terne plates. (The latter are not lighter than 107 pounds per base-box and are coated with approximately 75 per cent lead and 25 per cent tin.)
American Zinc Gage	Used in the United States for sheet zinc. The Continental Zinc Gage is used in Belgium, France, and Germany for zinc sheets, and has metric sizes and weights.
Sheet Lead Gage	The customary standard is based on weight per square foot. The corresponding decimal thicknesses are computed on a basis of 707.6 pounds per cubic foot.
Special Sheet Copper Gages	Comparatively heavy flat copper sheets are frequently made in definite weights in ounces per square foot. Copper sheets are also made in fractional inch thicknesses, varying by sixteenths from 1/16 to 2 inches. The Birmingham Wire Gage is used to some extent for copper sheets.
American Steel & Wire Co.'s Music Wire Gage	Gage for steel music or piano wire.
Decimal System of Specifying Sizes	The specifying of actual gage sizes is now done quite generally in preference to using gage numbers, in order to avoid any misunderstanding in regard to the required size.

MACHINERY'S Data Sheet No. 240, New Series, December, 1932

Notes and Comment on Engineering Topics

According to *Industrial Britain*, a process is being developed in Sheffield known as the Salerni process for low-temperature carburization. As yet, little is known about the details of the development. The rights to the process have been acquired by Neanthracite, Ltd., Sheffield, England.

The production of small parts from metal powder by a molding process somewhat similar to that used in molding synthetic plastics, is discussed in a bulletin published by Arthur D. Little, Inc. Tungsten, iron, chromium, nickel, copper, and various alloys are now being molded by this process. A predetermined amount of powder is placed in a steel mold and subjected to a hydraulic pressure of over 5000 pounds per square inch. The formed article is then heated to cause sintering. The product thus obtained has a structure that is in the nature of a metallic sponge, varying in density from one-third to four-fifths of the density of the pure metal, depending on the size of the metallic particles used, the pressure, the number of times the powder is pressed and heated, and the mechanical working to which it is subjected.



Metalspray Gun Used for Spraying Stainless Steel from a 1/8-inch Diameter Wire on Valve Plugs Revolved in a Lathe. The Process is Practically Automatic and Provides a 0.010-inch Coating to Resist Corrosion from Hot Oil in an Oil Refinery

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An interesting development in the manufacture of deep-well turbine pumps is incorporated in a pump made by the Johnston Pump Co., Los Angeles, Calif. In this pump, the impellers or runners, as well as the bowls, are lined with porcelain. This protective coating is said to increase the efficiency of the pumps about 5 per cent. In addition, it makes the pump acid-resistant, as well as effectively resistant to sand abrasion. After running pumps of this kind in a test equivalent to several years of service, pumping water heavily loaded with sand, the runners were inspected and found to have been subject to very little wear.

According to *Research Narratives*, published by the Engineering Foundation, 29 W. 39th St., New York City, in 1915 a pound of magnesium—the lightest industrial metal—cost $5; today it costs 30 cents! Only ten years ago, magnesium was thought of as an engineering material by only a few scientists and engineers. In the last five years, however, magnesium alloys have found important uses in many fields. The aviation and automobile industries obviously are in the lead; but even the railroads are finding increasing uses for magnesium alloys. Last year, the total American consumption was over 500,000 pounds. At the present time, there is only one American producer of commercial magnesium—the Dow Chemical Co., Midland, Mich. This company has conducted extensive research, with the results that magnesium alloys are now available to suit many varied engineering requirements.

Progress in the development of the so-called sodium vapor lamp, a new source of light having a brilliant yellow glow, is reported by the General Electric Co. The sodium vapor lamp is suitable where unusual lighting effects are desired or where an inexpensive light is wanted. It is not applicable in houses or stores where color values are essential.

EDITORIAL COMMENT

Present signs indicate that before long there will be an increase in the operating schedules in the machine-building and metal-working plants of the country. With a return of more active business, many problems of rehabilitation and maintenance of plant equipment will present themselves. Much repair work will have to be done. In the carrying out of such repair work, substantial savings are likely to be effected by an increasing use of the welding and cutting processes now available.

Welding Offers a Convenient Means of Rehabilitation

Welding and cutting methods have been highly developed during the last few years, and it is now possible to weld all the ordinarily used metals, including steel, cast iron, copper, brass, bronze, and aluminum. The stainless steels have recently been added to the number of metals and alloys that can be fabricated or repaired by welding.

Welding rods are available today with characteristics that meet the requirements of practically every welding job, insuring weld strengths that were unobtainable only a few years ago. One of the recently developed processes is bronze-welding, which has now reached a point where many important repairs can be made in place, avoiding the expense of dismantling and reassembly. By bronze-welding, worn parts can be quickly and economically built up to serve their original purpose.

Every plant in the metal-working industries should make certain that it is realizing to the fullest extent the economies that can be obtained by proper application of welding and cutting in production, maintenance, and repair work.

"I was glad to note the article by L. M. Waite, 'Suggestions for Inter-industry Planning,' in November MACHINERY," writes a man well known in the industrial field. "While Mr. Waite's suggestions may be years ahead of the times, it is likely that we must eventually apply some of these ideas."

A Study of the Causes Will Help to Prevent Future Depressions

There is no question but that business executives must take serious and active interest in the economic problems confronting us. It used to be thought that such problems were chiefly for economists and perhaps a few outstanding industrialists and financiers; but the average business man, it was said, should confine his attention to the practical problems of efficiency and production in his own organization. What has happened in the last two or three years, however, indicates that these broader economic problems are the concern of everyone engaged in manufacture or business. Every business man should give time and attention to these problems, because there is nothing that affects the stability of employment and the earning capacity of industry more than the depressions to which we have been periodically subjected.

It is obvious to every man in industry that something ought to be done, but the question is, What *can* be done? It is true that we cannot cure all of our business ills any more than the doctors can conquer all disease, but intelligent study of a few of the outstanding difficulties, followed by concerted action, would yield results and encourage further progress.

If the suffering and losses due to the depression do not bring about some small advance toward the correction of the underlying causes, we have learned nothing and salvaged nothing out of the wreck. Industry is conscious, as never before, of the defects in our economic system. This should spur business executives toward concerted action to prevent such severe disarrangements of industry in the future.

Years ago we heard a contractor admonish a carpenter because he came down the ladder from the roof where he was working to pick up a few nails that he had dropped on the ground. The carpenter's time walking up and down the ladder was worth a great deal more than the few nails that he might pick up.

Even the Elimination of Waste Should Have Facts as its Basis

The elimination of waste has been a popular subject during recent years. Factory managers, efficiency engineers, and editorial writers have emphasized its importance. Everything that formerly went to waste ought to be salvaged. This is perfectly good doctrine, and no one imbued with the idea of preventing waste should be discouraged. Yet, like all good things, even waste elimination can be overdone.

There are instances where, if every expense—direct and indirect—is carefully noted, it costs more to salvage than to scrap. In this, as in almost any other problem of management, the decision as to what to do should be based on a careful study of facts. Sometimes it pays to salvage and sometimes it does not. Inflexible rules are always expensive.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

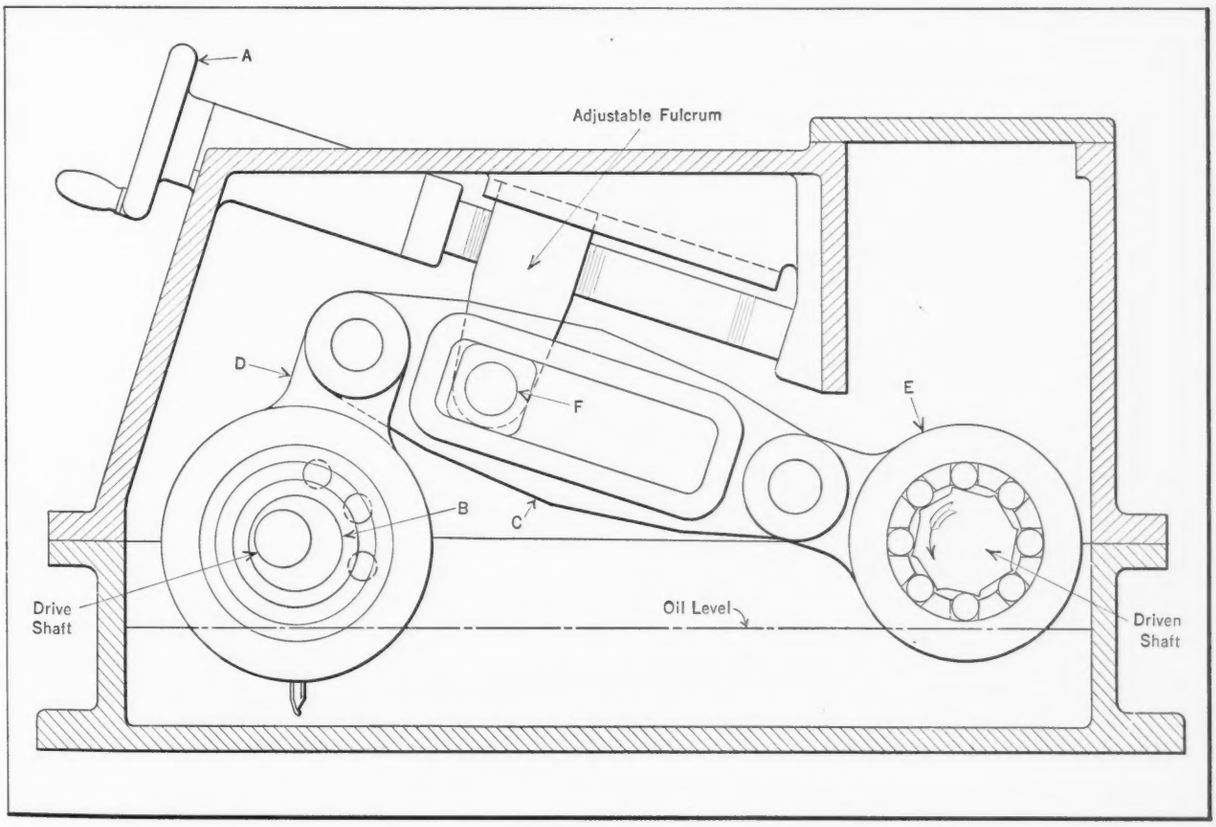
Gearless Variable-Speed Transmission

By R. T. TODD, Chief Engineer
Lenney Machine & Mfg. Co., Warren, Ohio

In many drives, it is desirable to be able to shift from one speed to another without stopping the machine and also to be able to obtain any speed between the maximum and minimum. A rather ingenious design which meets these requirements is shown in the illustration. It is compact, and instead of using gears, chains, or belts for transmitting the rotary movement to the driven shaft, levers and roller clutches are employed.

In this particular model, built and patented by the Lenney Machine & Mfg. Co., Warren, Ohio, any speed between 15 and 150 revolutions per minute can be obtained with the motor running at 1750 revolutions per minute. The speeds are instantly changed by turning the handwheel indicated at *A*. On the drive shaft are mounted a series of eccentrics *B*. These eccentrics are connected to levers *C* by yokes *D*. Roller clutches on the driven shaft are connected to the levers by yokes *E*.

As the drive shaft rotates, the eccentrics impart an oscillating movement to the left-hand ends of the levers *C;* and as these levers are pivoted at *F*, their other ends will also oscillate and impart a rotary reciprocating movement to the roller clutches within the yokes *E*. Each reciprocating movement of the clutches will cause the driven shaft to rotate a fraction of a revolution; and as the eccentrics are spaced uniformly about the drive shaft, the impulses given the driven shaft will be successive and overlapping. In this way, a uniform rotary movement of the driven shaft is obtained.



Variable-speed Transmission in which the Driven Shaft is Rotated through the Successive Movements of a Series of Roller Clutches

The oscillating movement of the right-hand end of the links *C* determines the amount the driven shaft turns during each impulse, and this oscillating movement depends upon the position of the fulcrum *F* along the slot in the levers. For example, if the fulcrum is moved down toward the right by handwheel *A*, the reciprocating movement of the clutch will be shorter, and a longer time will be required to rotate the driven shaft. Obviously, the entire range of speeds is covered smoothly, enabling the mechanism to glide from one speed to another. Although not indicated, forward and reverse rotation of the driven shaft can be obtained by merely shifting a lever. This lever may also be shifted to neutral to stop the driven shaft.

* * *

Stop Mechanism for a Power Press Equipped with a Magazine Feed

By EDWARD LAY

When parts become jammed as they are fed from a magazine to the dies of a press, it is likely to prove disastrous, not only to the die members, but to the press members as well. The most practical method of preventing damage in such a case is to stop the press instantaneously at the top of its stroke by some automatic means. This is done by the ingenious mechanism shown in the illustration, which makes it possible for one operator to tend three presses running at about 75 revolutions per minute.

This arrangement is in use on a battery of power presses equipped with automatic feed mechanisms, and has proved highly satisfactory. In addition to eliminating damage to press and die members, this mechanism also provides a valuable safety feature in that the movement of two levers is required to start the press. Hence, both of the operator's hands must be on these levers at this time and out of the danger zone.

Only the magazine feed-slide and tripping mechanism are shown. They are mounted on the baseplate *A*, which is secured to the press at a point adjacent to the magazine. The feed-slide, which is indicated at *B*, reciprocates in guides on the block *C*, this block being fastened to the baseplate. The reciprocating movement of the feed-slide is obtained through link *D*, rocker arm *E*, lever *F*, and cross-head *G*. Rocker arm *E* pivots about the stationary sleeve *J*, and lever *F* is pivoted to arm *E* at *K*. The lower end of lever *F* enters a slot in the side of sleeve *J* and is held against the side of plunger *L* by the spring *M*. With this arrangement, arm *E* and lever *F* oscillate normally as an integral unit. Thus, link *D*, which is attached at its upper end to the press ram, oscillates arm *E* and lever *F*, imparting an oscillating movement to the cross-head *G*, which operates in the vertical guides *H* on the feed-slide.

The oscillating movement of the cross-head causes the feed-slide to reciprocate and push the work from the magazine into the die. However, should jamming of the feed-slide occur, the lower end of lever *F* would immediately swing away from the side of plunger *L* and cause the tripping levers *N*, *O*, and *P* to operate, as will be explained later. Levers *N* and *O* are pivoted at *S*. Bracket *U*, secured to lever *N*, is held against the adjusting screw *T* in plunger *L* by means of the coil spring *R*, thus holding plunger *L* in engagement with lever *F*. Latch *Q*, on lever *O*, is normally held in engagement with lever *P* by the spring *V*. Link *W* is connected to the clutch mechanism, and when moved toward the right disengages the clutch and stops the press ram at the top of its stroke.

Assuming that the feed-slide *B* has jammed, the movement of the slide will be shortened or discontinued altogether, so that the lower end of lever *F* will leave plunger *L*, allowing the plunger to be forced further into the sleeve *J* by the lever *N*. As levers *N* and *O* swing together (by resetting and when jamming occurs only), the latch *Q* leaves the notched end of lever *P*, allowing this lever and link *W* to move toward the right under the action of a spring (not shown) and stop the press at the top of the stroke. The cause of the jamming can then be removed.

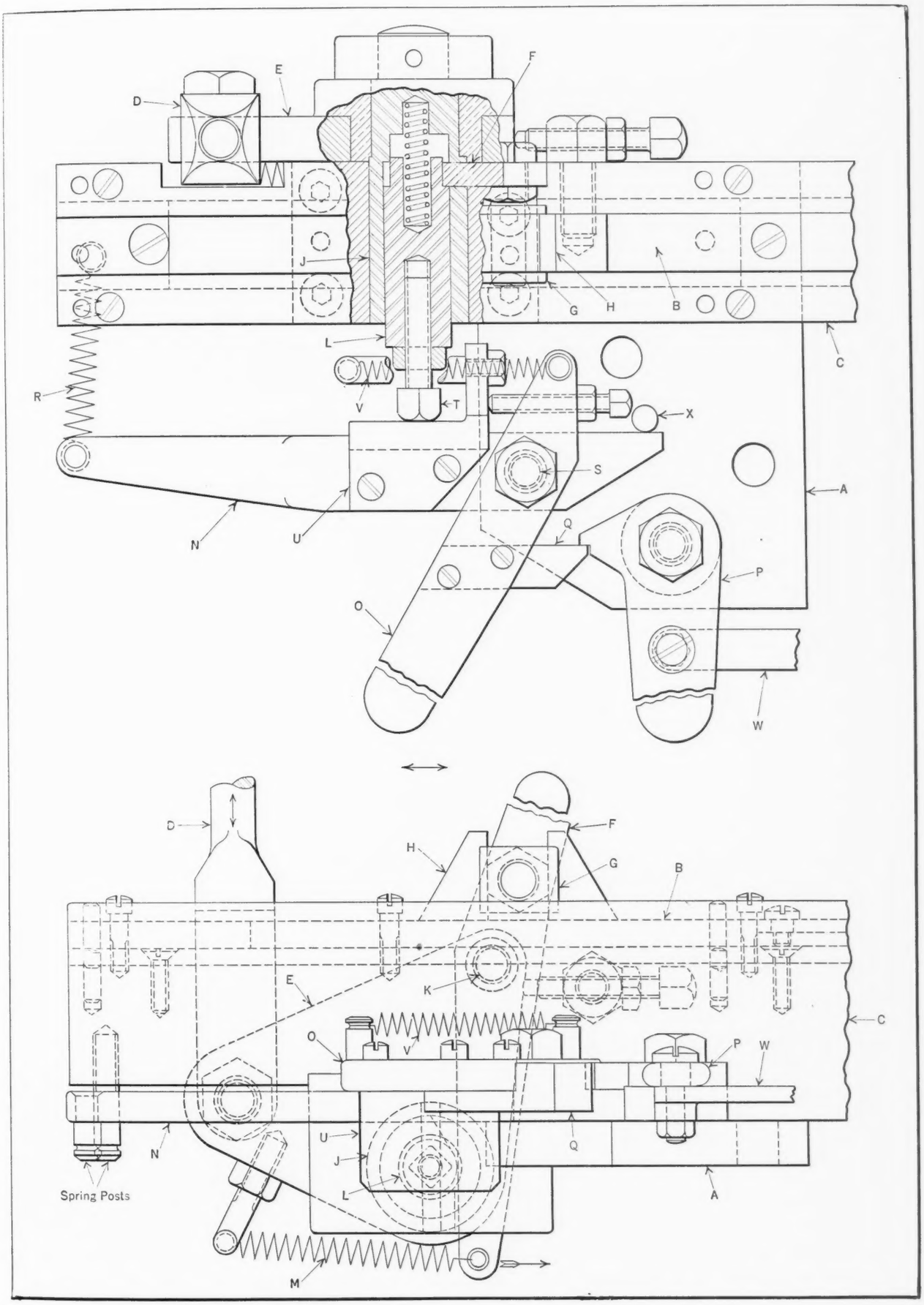
To restart the press, the operator grasps levers *O* and *P*. Lever *O* is swung toward the right, carrying lever *N* back into contact with the stop-pin *X*, and thus allowing the shoulder at the end of plunger *L* to once more engage the lower end of lever *F*. After this, lever *O* is swung slightly to the left to clear the notched end of lever *P*. Lever *P* is then swung to the left until its notched end engages the latch *Q*, thus throwing in the press clutch.

As the work is fed to the dies on the upward stroke of the ram, jamming of the feed-slide usually occurs at this time; hence, the press is stopped at the completion of this stroke, thus preventing damage to the press tools. This arrangement also insures the safety of the operator, as both hands are occupied with levers *O* and *P* when starting the press.

* * *

New Automatic Air-Control Valve

An automatic air-control valve, which permits definitely limited quantities of air to pass at different pressures, the quantity varying directly with the pressure, has been developed by the research department of the Jeddo-Highland Coal Co. The valve is now manufactured by the Yarnall-Waring Co., Philadelphia, Pa. The object is to prevent waste of air in the operation of pneumatic hammers and other pneumatic tools used in mines, foundries, machine shops, and structural work. The valve is placed near the end of the air line. In operation, the device is adjusted for a given size of tool and for the flow of air required for that tool; after that, the valve is sealed to prevent tampering.



Tripping Mechanism which Automatically Disengages the Press Clutch when the Magazine Feed Jams

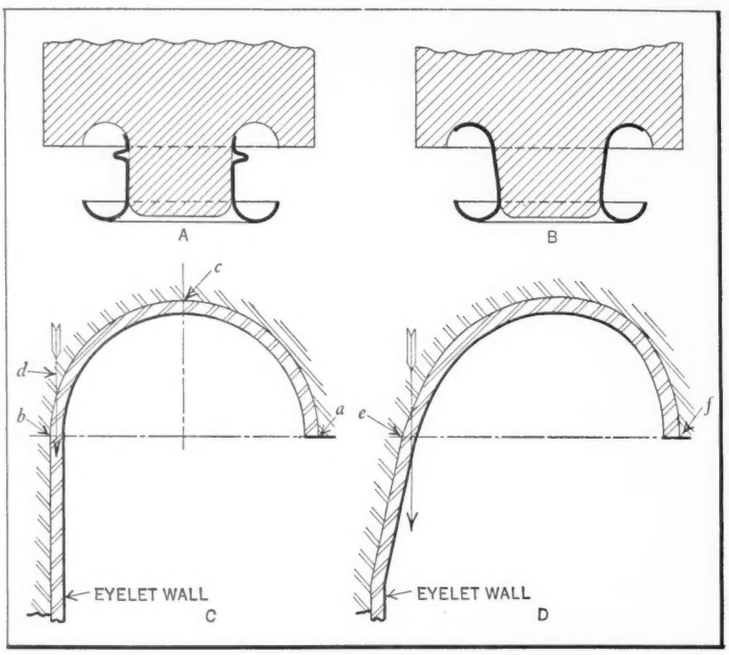
Developing a Punch for Curling Eyelets

Split and Telescoped Eyelets are the Penalty Paid for Assembling with Punches Poorly Developed or Carelessly Designed

By H. R. SCHMIDT

TROUBLE is often experienced, in heading eyelets made of thin stock, from the eyelet collapsing, splitting at the ends, or curling imperfectly. The contour of the punch used for this purpose is generally developed by the cut-and-try method. Unless the mechanic has a definite idea of the correct shape, much experimenting will be required before the punch is satisfactory.

Collapsing of the eyelet, as indicated at *A* in the illustration, is caused by beginning the curl too close to the straight pilot, which makes the vertical pressure on the walls of the eyelet excessive. This type of punch usually produces a beading effect, which for the purpose here referred to is undesirable. Splitting of the eyelet is caused by leading the metal too far from the pilot, as indicated at *B*. In this case, the diameter of the curl is large, and the resulting stretch of the metal is excessive, thus causing a fracture at the end of the eyelet.



Examples of Incorrectly Designed Curling Punches and Diagrams Comparing them with a Correctly Designed Punch

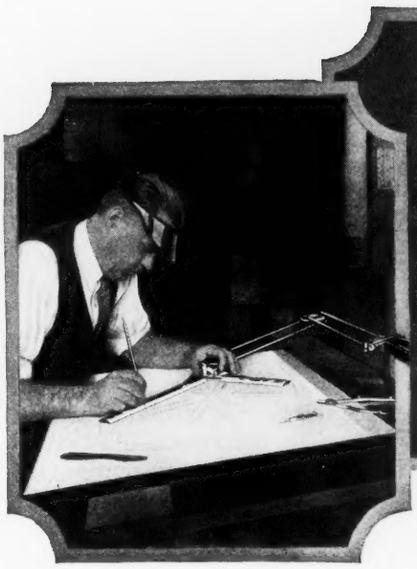
Diagram *C* shows clearly how the eyelet collapses. The semicircle represents the curvature of the curling portion of the punch. Here all the bending action takes place just above point *b*. The function of the curved punch surface up to point *c* is to stretch the metal and thus prevent restriction of the bending action above point *b*.

From the foregoing it is obvious that the entire bending stress is concentrated just above point *b;* hence the resultant vertical pressure will be along arrow *d*, compressing the eyelet walls and tending to collapse the eyelet. If the bending action could be distributed along the punch contour instead of being at one point, few collapsed eyelets would result. The reason is that less vertical pressure would be required, as only a small part of the bend would be made at one time.

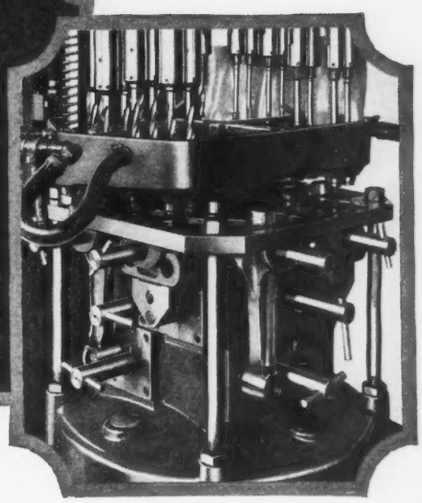
A punch having a contour that produces this result is indicated at *D*. The cross-section of the curling portion is a spiral curve tangent to a tapered pilot. The action is as follows: The metal is stretched by the pilot till it reaches point *e*. Just as the end of the eyelet passes this point, bending starts. At this point the resultant vertical pressure does not pass through the eyelet wall, as at *C*, but off to one side, thus permitting free bending. As the end of the eyelet continues along the spiral surface, the bending is done gradually until, at point *f*, the curl is completed. In this way, the compressive strength of the eyelet wall is sufficient to resist the slight vertical pressure resulting from the bending action. In developing the punch contour, however, point *f* should not be located too far from the pilot; otherwise splitting will result. The principles governing the design described here could also be used to advantage for larger punches of a similar nature.

* * *

Muscular effort in the operation of clutches on heavy buses and trucks has been practically eliminated by the use of compressed-air equipment, developed by the Bendix-Westinghouse Air Brake Co. This company has also developed a special emergency brake equipment that assures automatic application of the emergency brake on a truck or trailer, or both, in case of air-line breakage.



Design of Tools and Fixtures

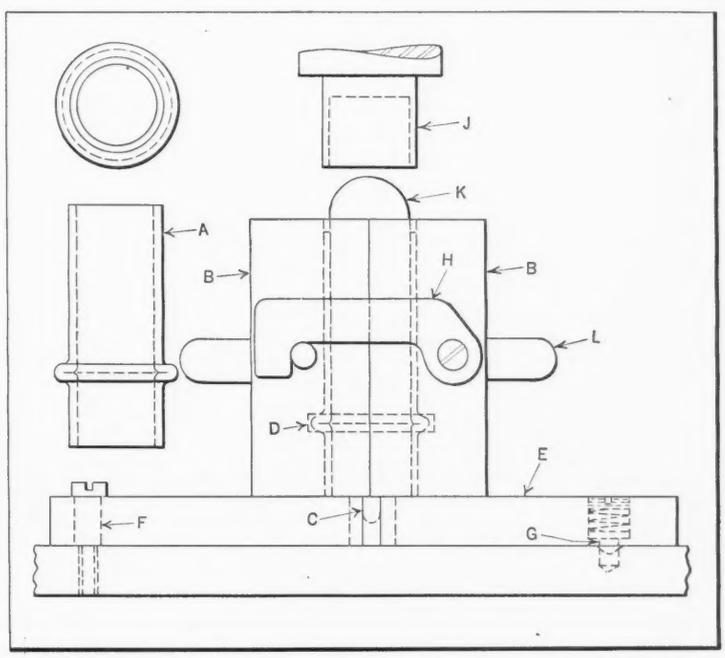


Simple Die for Flanging Tubing

By WALTER SIMPSON, Philadelphia, Pa.

In order to form a flange at some distance from the end of a round tube, the writer built the die shown in the accompanying illustration. This die is of the split type, which facilitates the removal of the finished work indicated at *A*. The split members *B* are hinged at *C*, and are bored to a diameter slightly larger than the outside diameter of the tube. A groove *D* in these members is of the same width as the flange to be formed. Owing to lack of space between the ram and the press table for inserting the tube in the die, the die was mounted on the plate *E*, which is pivoted at *F*. With this arrangement, the plate can be swung outward, so that the tube can be inserted in the die without interfering with the upper die members. The plate is located in its operating position by the spring plunger *G*.

After inserting the tubing over the mandrel *K*, which is secured to plate *E*, the split members of the die are locked together by means of the latch *H*. The plate is then swung into the operating position and locked by the plunger *G*. The punch *J*, in descending, compresses the tubing. As the tubing is confined at every point but at the grooved portion of the die members, it will be forced into the groove at this point, thus forming the double-walled flange. The diameter of the flange can be varied by adjusting the stroke of the punch. Handles *L* were provided to facilitate the opening and closing of members *B*.



Die for Forming a Flange at Some Distance from the End of a Tube

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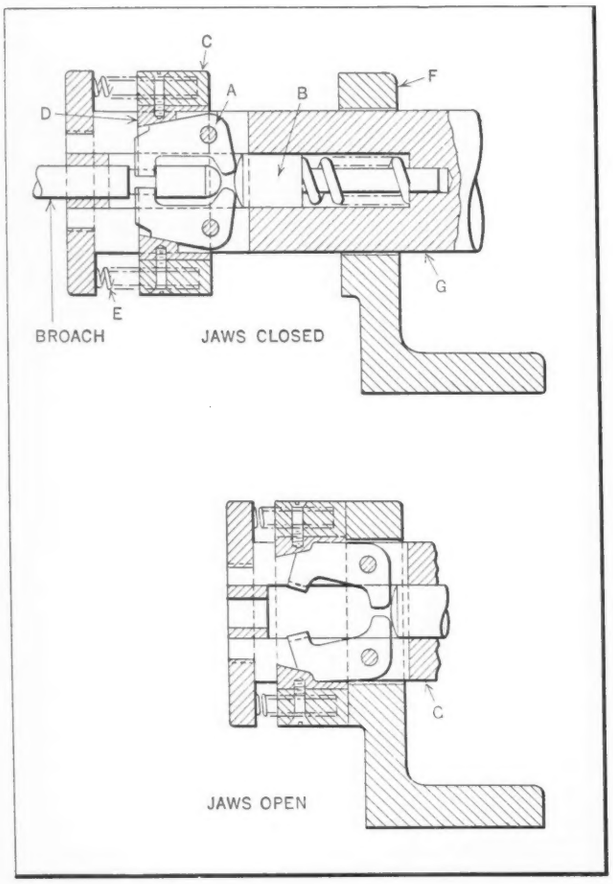
Broach-Holder that Opens and Closes Automatically

In order to reduce the time lost in attaching and detaching broaches in multi-slide draw-broaching machines that operate continuously, a holder of the type illustrated (see next page) was designed. This holder is automatically locked and released, allowing the operator to devote his time to loading the work on the broach.

The holder is shown in its closed position in the upper view. It is fastened to the end of the pull bushing *G* of the machine slide, and consists chiefly of the jaws *A*, which are clamped on the end of the broach by



Holder for Automatically Clamping and Unclamping Broach in Draw-broaching Machine

means of the sliding collar *C*. This collar is held in the locked position through the action of the coil springs *E*. When the collar is forced to the left, the jaws are immediately opened by the plunger *B*, which is also backed up by a coil spring. Hardened inserts *D* are provided in collar *C* to prevent excessive wear.

As the machine slide moves toward the right from the position shown in the upper view, the work (not shown) is broached. Near the end of the working stroke the collar *C* comes in contact with the stationary stop *F*. As the machine slide continues to move toward the right collar *C* is forced along the pull bushing *G*, as indicated in the lower view. Here it will be seen that the movement of collar *C* has allowed the jaws to swing outward under the action of plunger *B*, so that the broach can be removed from the machine.

It will be further noted that the jaws serve as latches and prevent collar *C* from returning to the locked position during the return or idle stroke of the machine slide. At the end of the idle stroke, however, the broach, which in the meantime has been reloaded with work, is thrust into the holder and against the heels of the jaws. This releases collar *C*, which is immediately forced to the right by the coil springs *E*, again clamping the broach in the operating position indicated in the upper view. J. P.

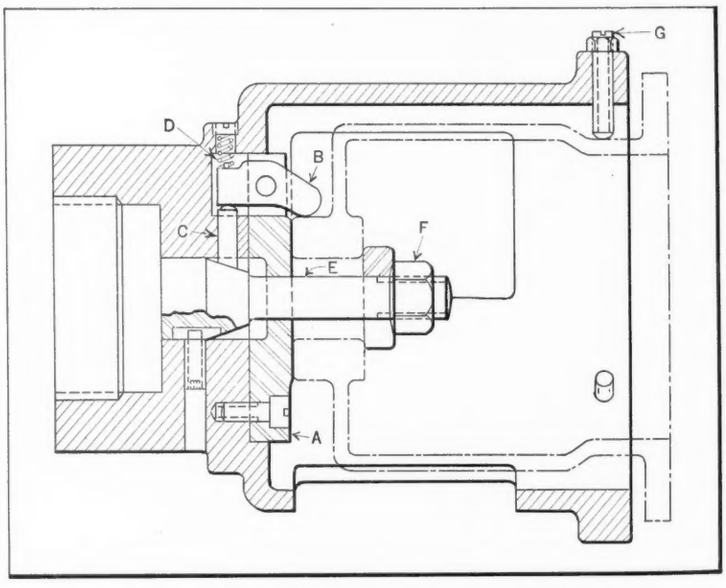
Pot Chuck with Combined Centralizing and Clamping Feature

By D. L. BROWN, Summit, N. J.

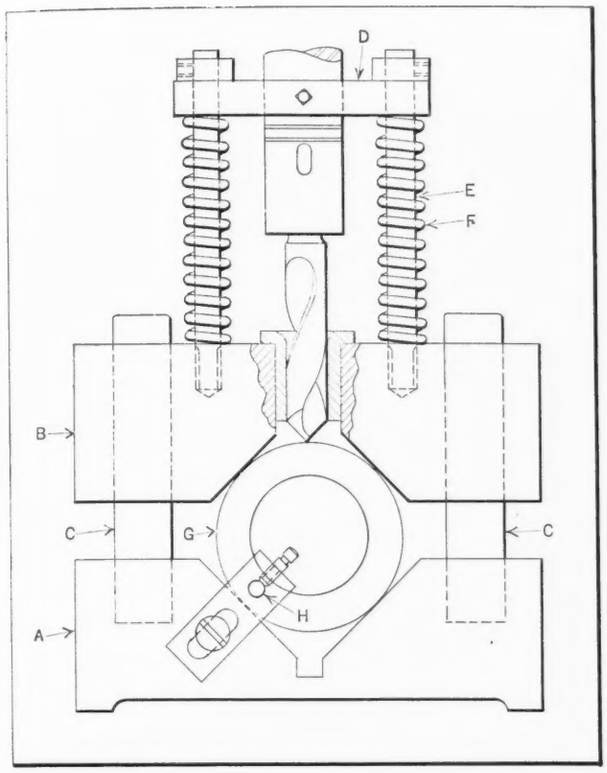
One objection to the use of pot chucks in lathe work is that the end of the work in the pot is inaccessible, as a rule. This makes it difficult to centralize the work properly unless some special provision is made like that shown in the chuck illustrated. This chuck is used for holding the differential casing indicated by the dot-and-dash lines while the flange is being faced and turned. The casting must be trued up accurately at both ends before this operation is performed, and because of the frail construction, extra precaution must be taken in clamping the casing.

The hub of the casing is clamped against the steel plate *A*, secured to the pot. This plate has three equally spaced slots cut around its periphery in which the fingers *B* are pivoted. One end of each finger bears upon the hub of the casing while the other end is held against pins *C* by the coil springs *D*. The pins, in turn, rest against the tapered portion of a sliding bolt *E*.

Thus, by tightening nut *F*, the hub of the casing is clamped against the plate *A* and at the same time centralized by the fingers *B*, which are forced against the hub through the action of pins *C* sliding on the tapered portion of the bolt. Screws *G* serve to centralize and clamp the outer end of the casing. However, only one of these screws is loosened in loading. With the arrangement described, there was little distortion of the casing in clamping.



Pot Chuck in which the Work is Centralized and Clamped Simultaneously



Self-clamping Jig for Drilling Collars of Different Diameters

Universal Jig for Drilling Collars

By CHARLES KUGLER, Philadelphia, Pa.

A job often met with in the machine shop is the drilling of screw- and pin-holes in collars. In one plant, a sufficient quantity of this work was done to warrant the construction of the jig illustrated. This jig may be used for collars of different diameters. The clamping and unclamping of the work is automatic.

The jig consists of the V-block *A* for supporting the work and the V-block *B*, which serves as a drill bushing plate as well as a clamping member for the collar. These two V-blocks are held in alignment with each other by the pillar posts *C*, the lower ends of which are a tight fit in V-block *A*, and the upper ends a sliding fit in V-block *B*. V-block *B* is connected to the spindle sleeve of the drilling machine by the cross-bar *D* and the tie-rods *E*. Springs *F* provide the necessary pressure for clamping the work.

As shown, the collar *G* is in position against stop *H*, mounted on the lower V-block. As the spindle descends, the pressure of the springs on V-block *B* clamps the work securely, and as the spindle continues its downward movement, the hole is drilled. By merely raising the spindle, the jig is unclamped to allow the work to be removed.

In jigs of this type, the upper V-block can be provided with interchangeable slip bushings for drilling holes of different sizes or for reaming or tapping the drilled holes.

Gage for Checking Inaccessible Tapered Holes

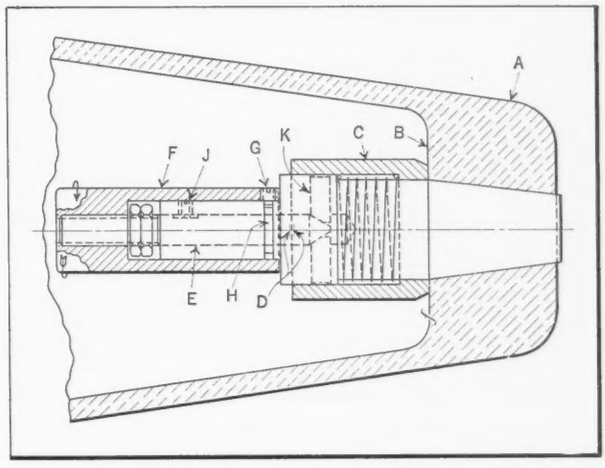
By H. KAFFINE, West Reading, Pa.

When tapered holes that are to be held within close limits are being bored, checking may be done accurately with the gage shown in the illustration. This gage is particularly useful for checking holes where the gaging points or surfaces are inaccessible. For example, the gaging surface for the tapered hole in the casting *A* is indicated at *B*. Owing to the fact that the casting is enclosed at this point, it is impossible to see the position of a mark on the gage relative to the gaging surface.

This difficulty was overcome by the use of the sliding sleeve *C* which can be locked in position against the gaging surface after the plug is seated in the hole. After locking the sleeve in this manner, the gage is removed. The position of the left-hand end of the locked sleeve relative to the two graduation marks *D* determines the accuracy of the tapered hole. In this case, the distance between the marks is 0.020 inch, corresponding to a tolerance on the diameter of 0.005 inch, the taper being 3 inches per foot.

The locking arrangement consists of the conical pin *E*, acting against the locking pins *K*. The threaded end of pin *E* engages the tapped hole in the handle *F*. The handle is a slip fit on the shank of the plug, and is retained on the plug by the screw *G* in the annular groove *H*. Screw *J* engages a slot in pin *E* and prevents the pin from rotating in the shank of the plug.

In checking a hole, the handle *F* is rotated in the direction of the arrow. This will cause pin *E* to move toward the left and allow the pins *K* to recede and unlock sleeve *C*. The plug is then inserted in the hole and the handle again rotated in the direction of the arrow until the bottom of the hole in the handle comes in contact with the check-nuts, thus locking the handle to the plug. Continuing the rotation of the handle allows a slight wringing action to take place, which seats the plug in the hole. In



Gage with Locking Sleeve for Checking Tapered Holes Having Inaccessible Gaging Surfaces

the meantime, the sleeve is held firmly against the gaging surface *B* by the coil spring. After the plug has been seated, the sleeve is quickly locked in position by rotating the handle in the opposite direction. The plug is then removed from the hole and the position of the sleeve relative to the graduation marks noted. To avoid unnecessary rotation of handle *F*, the check-nuts are adjusted to come in contact with the bottom of the hole in the handle as soon as locking pins *K* disengage sleeve *C*.

Progressive Die for Hinges

By CHARLES D. OLSON, Rockford, Ill.

In the manufacture of dial indicators, padlocks, and other parts of hinged construction, it is sometimes necessary to reduce the outside diameter of the curled portion of a hinge and yet maintain a certain size pin and a given thickness of the hinge leaves. In Fig. 2 is shown a steel hinge member of this type. The section to be curled for the hinge pin has been swaged and given a partial curl. A plan view of the die used to produce this blank is shown in Fig. 1. It is of the progressive type, the sequence of operations being piercing, swaging, curling, and blanking.

To make it possible for the hinge to be swaged at *A* without distorting the rest of the strip, section *B* is pierced at the first station, thus leaving room for the displaced metal at the next station. The blanking punch (not shown) at the third station is rounded over at the right to form the partial curl as the piece is cut from the strip. Another die is, of course, required to complete the curl. The upper view in Fig. 1 represents the strip after it has passed through the die.

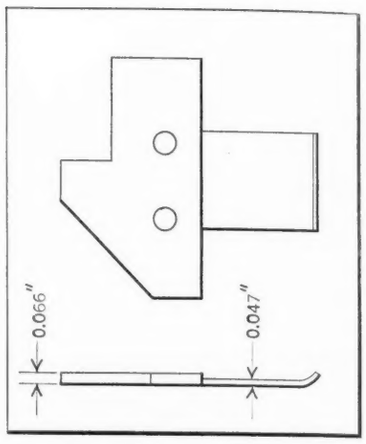


Fig. 2. Hinge Blank Made from Strip Stock in the Die Shown in Fig. 1

The swaged part of the scrap is not severed from the strip during the operation; this eliminates jamming of the strip under the stripper plate.

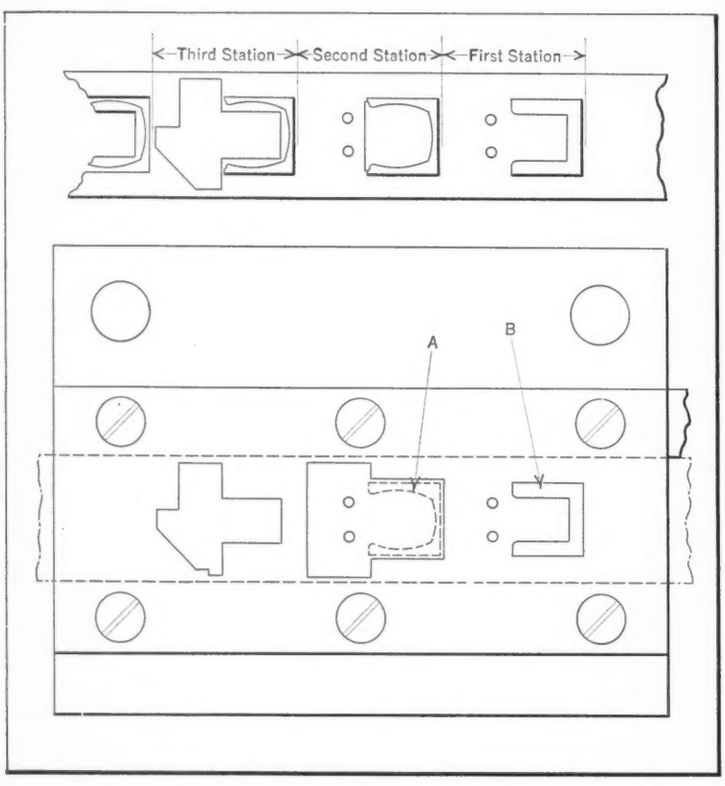


Fig. 1. Progressive Die for Piercing, Swaging, Curling, and Blanking the Hinge Part Shown in Fig. 2

* * *

Credit Arrangements Between Germany and the Soviet Republic

The agreement recently concluded between representatives of German industry and the Soviet Republic includes the following arrangements in regard to credit extended by German engineering concerns in connection with Russian business. The agreement runs to May 31, 1933. Under this agreement, orders are divided into three classes, the terms of payment applicable to each group being as follows:

A. When the order is placed, 20 per cent is to be paid in acceptances due fifteen months from the date of placing the order; 40 per cent is to be paid in fourteen months after delivery of the order; and 40 per cent in sixteen months.

B. When the order is placed, 20 per cent is to be paid in acceptances due nineteen months from the date of placing the order; 40 per cent is to be paid in eighteen months after delivery of the order; and 40 per cent in twenty-four months.

C. When the order is placed, 20 per cent is to be paid in acceptances due twenty months from the date of placing the order; 40 per cent is to be paid in twenty-five months after delivery of the order; and 40 per cent in twenty-nine months.

Interest is calculated quarterly, payable by six months' acceptances. The rate of interest is to be 2 per cent above the German Reichsbank rate, but never more than 10 nor less than 7 per cent annually. The acceptances issued when the order is placed bear no interest for three months.

Future Developments in Machine Tool Design*

An Outline of the Probable Trend in Machine Tool Developments During the Next Decade

By GUY HUBBARD

IT is the author's belief that the progress in machine tool development that has taken place during the last three years surpasses that of any similar period. These years have been truly a period of revolution in machine shop practice. This is by no means the first time that an economic depression has stimulated engineering developments in the machine tool field. It was during the slump of 1857 that the first commercially successful turret lathe was developed. The first universal milling machine was designed and built during the depression of 1861-62, and it was during the panic of 1873 that the first automatic screw machine was developed. The first multiple-spindle automatic was designed and built during the depression in the nineties.

This activity in periods of industrial depression is by no means accidental. In boom times, the machine tool builder and his entire staff are too busy with the perplexing problems of high-pressure production and with special tooling intended for definite purposes to give much time to new designs, but when orders fall off sharply, the engineering brains of the organization are free to tackle real design problems.

It is of interest to note that most machine tool developments have apparently been ahead of their time. For example, it took forty years for the turret idea to be widely adopted in production machine shop practice. The automatic screw machine did not become generally used until nearly thirty years after its appearance. It took nearly twenty-five years to catch up with the possibilities presented by high-speed steel cutting tools. The advantages of heavy-duty anti-friction bearings have been known for at least twenty years, yet it is only since 1925 that their application in machine shop practice has become widespread.

At the present time, however, there seems to be a difference in the manner in which industry accepts a new development. This is best exemplified by the almost immediate reaction to cemented-carbide cutting materials. Tungsten-carbide tools have not been generally known in the United States for more than four years, and yet all the leading American machine tool builders have designed their latest machines to suit this new cutting material.

Trend of Machine Tool Design in the Next Few Years

To undertake to forecast trends of either business or engineering is risky. However, it is possible to say with a reasonable degree of certainty that in the next five years the technique of the manufacture and application of carbide tools will reach an appreciable degree of perfection and that the improvements in high-speed steels, inspired by the advent of the new cutting materials, will bring the older cutting materials to a high degree of perfection as well. While the new cutting materials may be able to perform some operations previously reserved for the grinding wheel, grinding practice, in turn, is destined to make gains as a primary operation on work now ordinarily "roughed" by cutting tools and subsequently finish-ground. The advances in grinding practice will be promoted by further improvements in abrasive wheels and in the development of heavy-duty grinding machines. More fully automatic types of grinding machines will appear and will be provided with automatic loading and unloading facilities and gaging means.

New Methods will be Adopted to Make Higher Speeds Practicable

The speeds of production machine tools will be increased to meet the requirements of the new cutting materials. Anti-friction bearings will be more widely used and more attention will be given to provide vibrationless operation. The bearing manufacturer will cooperate with the machine tool builder to produce bearings that will fill all the requirements that may be placed upon them. Hardened helical gears, finished by precision grinding, will be used to an ever increasing extent. More attention will be paid to the exact balancing of rotating parts, and undue shocks resulting from the starting and stopping of reciprocating and intermittently revolving parts will be eliminated largely by the reduction in weight of these parts, partly by the use of light-weight alloys, and partly by improved mechanisms.

Much of the effort in future machine tool design will be expended upon the reduction of the idle time of the machine. This will further emphasize the importance of accurate balancing of moving parts and of shockless operation. Rigidity will be obtained by the proper distribution of metal rather than by wholesale additions of weight. Rule-of-thumb designing methods will give place to those based on correct analysis. The old adage, "What looks right is right," is going to be reversed to read: "What is right looks right."

Welding will become a recognized method for building much machine tool equipment. Motor drives will gain in popularity and auxiliary motors will be employed for different motions of the machine.

*Abstract of a paper presented before the Machine Shop Division of the American Society of Mechanical Engineers at its meeting in Buffalo, October 3.

Hydraulic feed and control and hydraulic, pneumatic, and magnetic chucking are destined to become more common than today, although they will not replace mechanical methods for many purposes. Controls will be simplified and centralized. Push-buttons and rheostat handles seem destined to supplant handwheels and mechanical operating levers eventually.

Lubricating Means will be Much Improved

Lubrication will become more and more automatic and every bearing will receive its oil from a central point. Lubrication in the past has been largely a matter of tradition; in the future it is more likely to be a matter of engineering. Cutting oils and compounds will be made more effective through better understanding of their functions. There will be fully as much specialization in the field of coolants as there will be in the field of industrial lubrication. Lubricants, lubricating means, and coolants, will be made to suit the requirements of different types of machines.

Automatic work-handling mechanisms will be employed to an ever-increasing extent and better means will be provided for taking care of the chips, either as a part of the machines or apart from them. The machine itself will, to a greater extent than formerly, inspect its own work. Many machines are already provided with automatic gaging means.

One may even look forward to a still further transfer of skill and intelligence from the designer directly to the machine tool than we have yet attempted. It is by no means beyond the realm of possibility that this transfer of skill and intelligence may reach a point where certain high-production machine tools will be controlled by means of perforated strips or cards in a manner comparable to the control of the Jacquard loom, the player piano, or the Hollerith tabulating machine. With control from a templet already incorporated in the Keller control engine lathe, and with reports from Germany of a grinder controlled directly from an accurately made drawing, this development may not be so far away as we think. Compared with the automatic machines used in the textile industry, in canning and bottling establishments, and in cigar and cigarette factories, for instance, the most highly developed machine tools of today are comparatively simple mechanisms; but they do present the peculiar problem of combining high precision and high speed with abnormally great strength and power. Nevertheless, we may expect to see automatic machines developed to a point that has not yet received the attention of the machine tool designer.

The development of civilization has been the history of the development of tools, and when tool development has received a temporary setback, civilization momentarily has made no progress. Men use inefficient tools not by choice but through necessity. It seems to the writer that economists who see in hand work or ineffectual tools the answer to our industrial problems are misinterpreting every lesson to be learned from history. Proper use of these remarkable production machines, proper distribution of their products, and sane handling of financial problems will eventually produce more work for more men than any artificial stimulation of industrial inefficiency, such as has been proposed by many who we had been led to believe should have been able to give us better advice.

109 Degrees Below Zero!

It is difficult to believe that a temperature of 109 degrees below zero is ideal for some manufacturing operations. Nevertheless, it is a fact that some remarkable results are being obtained by the application of such a low temperature in the metal-working industries through the use of dry ice. How this is accomplished will be described in an article in January MACHINERY. Dry ice is being used to cause metal parts to contract in order to facilitate their assembly into other pieces; to keep aluminum-alloy rivets in an annealed state until used; and to harden certain steels by cooling them to abnormally low temperatures. The article to appear in January MACHINERY is based upon the practice of well-known manufacturing companies, including the American-La France & Foamite Corporation, the Boeing Airplane Co., and the Carpenter Steel Co. Men in the mechanical industries will find this article of unusual interest; it may suggest applications in their plants.

Abrasives and Grinding Wheels Have Kept Pace With Modern Trends

Equipping for the New Needs of Industry
Section 12

PROGRESS in the abrasive industry is measured by one principal yardstick—the closeness with which abrasive products are made to fit the particular job they are to do. Today more than ever any grinding or polishing application must be highly specialized. Very definite grinding or polishing action is necessary wherever abrasive wheels or grain (or bricks or sticks) are used in any appreciable quantity.

In recognition of this fact, leading manufacturers of abrasive products are constantly adding refinements—narrowing the grinding action of individual products to fit them much more definitely for the work they are to do. They have not only studied abrasives and bonds, and methods of combining them, but they have also focussed their attention on the point where the abrasive meets the material, to determine what actually takes place there and why. Marked improvement in, and control of, abrasives have resulted from these studies. Not only have the size, shape, and similar physical properties of grain been improved, but the actual crystalline structure has been varied to meet specific grinding or polishing actions.

Recent Improvements in Abrasive Grains

Through petrographic study, one manufacturer has definitely classified crystalline characteristics of abrasives, such as size, shape, and purity, and from this study has developed methods of controlling and varying crystalline structure to give the abrasive the required physical properties for specific requirements. Especially is this true of crystalline aluminum oxide. One type of this abrasive has pure crystals, free from slag impurity. Such an abrasive is designed to be used for severe grinding and polishing of metals of high tensile strength. Another variety of pure aluminum oxide has a different crystalline structure. It is deliberately made with hollow bubbles and elongated cavities running through it, which persist after the grain has been crushed. This grain is used where a peculiar breaking down action is required, particularly on metals of high tensile strength, where stresses are light. A third type of abrasive combines the physical properties of the other two, and is applied on metals of high tensile strength where polishing conditions are of medium severity.

Extensive study has established the fact that the shape of grain is one of its most important characteristics; that it very definitely affects the abrasive action of the grain. From the same piece of ore, grains of different shape can be produced by mechanical operations, and the products will give entirely different results. This is true of either aluminum oxide or silicon carbide, the two principal electric furnace abrasives.

Leading manufacturers of abrasives have therefore deliberately added operations to their manufacturing routine to shape grain mechanically. For severe grinding or polishing conditions, generally speaking, they produce grains of the solid, chunky, angular type, which offer resistance to the stresses of grinding or polishing. For less severe conditions the shape of the grain is altered to cause a different action—a "quicker" fracture to get resultant sharpness. And for still other work, such as in the abrasive paper and cloth field, where the stresses are extremely light, another shape of grain is produced. Often, too, these shapes are used in combination, so that today it is possible for the wheel manufacturer to produce widely varying wheels from the standpoint of abrasive action—a development of great value to the user of abrasives.

Developments in the Sizing of Abrasive Grains

The development in sizing of abrasive grain has also been striking. Leading manufacturers today have devised methods by which it is possible to increase, in any given grain size, the percentage of nominal or basic size grain to a remarkable degree. Manufacturers have united in effecting a standardization of grain sizes that contributes not only to the improvement of polishing in general, but also to the improvement of grinding wheels.

More recent developments in abrasives have led to special treatment of grain for polishing. Some of the leading manufacturers subject grain to one type of treatment for severe polishing and to a different type of treatment for less severe conditions. Each treatment, however, is designed to make the grain adhere better with glue, and consequently to produce not only stronger, but more uniform, polishing wheel heads. A third type of treatment prepares grain especially for the abrasive paper and cloth manufacturer.

The Development of the Bond Has Followed Equally Progressive Lines

When grinding wheels were first made, the majority of them were bonded with a vitreous or glass bond. As the field of grinding developed and new metal alloys were introduced, it became necessary to add new types of bond, because of the nature of the material being ground. There are now essentially five types of bond being used—vitreous, shellac, rubber, silicate, and synthetic resin. Particular attention has been centered on two types of bond in recent developments. These are the vitreous and the synthetic resin bonds.

One leading manufacturer has recently patented an entirely new type of vitreous bond that, it is claimed, will greatly broaden the field of service for this type of wheel. This bond is said to give to the wheels a distinctive grinding action and a greater degree of permanency. It is also stated that the bond makes possible definite and extremely close duplication of vitrified grinding wheels.

The application of synthetic resin bond to grinding wheels has been considerably broadened during the last few years. It was first used in cutting-off and snagging wheels. The application of synthetic resin as a bond for grinding wheels has contributed largely to the development of high-speed snagging practice. More recent developments with this bond have been the production of coping wheels and cam grinding wheels. Further experiments are being made with this type of bond. There has also been some development with rubber bond for specific snagging, coping, and cutting-off operations.

Improvements in the Methods Used in Grinding Wheel Manufacture

The trend of improvement in methods of manufacturing grinding wheels has been toward the pressed wheel and away from the puddled wheel, although puddled wheels continue to be used in greater quantity than any of the other process wheels. However, there have been some remarkable developments in the methods of wheel making. One manufacturer uses a new method by which it is claimed that the volume structure of a grinding wheel is definitely predetermined and regulated. This method is said to regulate the relationship of abrasive, bond, and pore space in a wheel, so that a wide variety of grinding actions may be effected, although the grain and grade are exactly the same. It is also claimed that the method permits very close duplication of grinding wheels.

Wheels Developed for Special Purposes

The specialization of products has led to the development of many wheels for specific purposes. One of these is the so-called lug-mounted type of wheel which is used for side grinding. This construction permits the use of appreciably more of the grinding wheel than was possible when wheels were mounted on chucks. Another type of special wheel is the so-called "Cork-Bakelite" wheel for ball grinding and for obtaining a high finish on rolls. Wheels with specific physical properties also have been developed to grind cemented tungsten carbide, tantalum carbide, and similar materials.

Examples of Savings Due to Better Grinding Wheels

Recent improvements in grinding wheels have made marked savings possible. A leading manufacturer of grinding wheels mentions that, through improved structure of wheels, 267 crankshafts are now being ground per wheel, as compared with 200 in the past. In grinding chrome-steel valve stems on a centerless grinding machine, a 20 per cent increase in production per wheel has been obtained. In another instance, steering wheel sleeves are rough-ground on a centerless grinding machine. Formerly, the wheels lasted about 28 hours, whereas the new wheels have a life of 48 hours. Still another instance may be mentioned—grinding the end of coil springs. Previously about 27,000 springs could be ground by one pair of wheels, while now 37,000 can be ground.

Grinding Wheels for Obtaining Unusually High Finish

Solid grinding wheels have been introduced capable of producing the high finish ordinarily obtained by burnishing or by lapping with compound or any loose-grain abrasive. These wheels are made from abrasives of extremely uniform grains or grades in the finest sizes. They are not intended for production grinding, in the sense of removing a large amount of metal, but rather for producing the final luster after a series of progressively fine wheels have been used to remove gradually diminishing amounts of stock, in order to prepare the surface for the final finish. These wheels are used for finishing piston-pins, bearing raceways, and various types of rolls used in the metal and textile trades. To obtain the best results with them, it is necessary to use grinding machines in first-class running order, so that there will be no vibration.

Improvements in Abrasive Disks

Several new types of abrasive disks consisting of a steel plate backing to which the abrasive grain is bonded by various means are now available. When these abrasive disks were first brought out, it was intended that the user should return the steel plates to the company making them for refilling after the abrasive had worn away. However, this practice proved inconvenient and further improvements have been made, so that when the abrasive has been worn away, it is more economical to throw away the steel backing than to attempt to refill it with

abrasive. Such abrasive disks are made up to 6 feet in diameter.

Recent Progress in Lapping Abrasives

Recent and present tendencies of industry toward high speeds, noiseless operation, and lower costs have forced lapping, as a process, into the engineering field. Lapping has ceased to be an art and may now be termed an exact science, made possible through the development of either new abrasives or new applications of those already in existence.

Until a short time ago, common emery and silicon-carbide grains were sufficient for all lapping needs. Owing to the uncertainty of the first and the harshness of both, neither will now serve as all around lapping media. Then, too, neither of these abrasives is generally safe to use on non-ferrous metals, as each has some tendency to "charge" or impregnate. For certain classes of work, neither is available in required degrees of fineness and softness of action.

Present-day requirements have resulted not only in the development of softer and finer lapping abrasives, but also in their incorporation in suitable vehicles, ready for use—not so much for convenience, but to eliminate the human element in mixing, since a slight variation of proportions of abrasive to vehicle may materially alter the abrasive effect. Properly compounded, such ready-to-use mixes should cost no more than the unmixed ingredients, on a production-cost basis.

These modern developments have made possible the commercial lapping, with safety and economy, of such parts as soft steel and non-ferrous gears and worm sets, bronze-seated poppet valves for airplanes, bronze slide, globe, and gate valves, and tungsten-carbide tools.

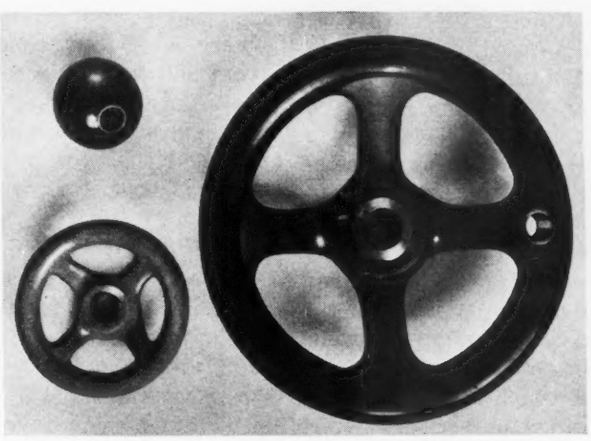
The nature and fineness of certain compounds has made it possible to lap close fitting parts together, as, for example, fuel oil pumps, with their unpacked plungers, which must operate at high pressures without leakage. Pistons, with or without rings, can be lapped to their cylinders. Knife or razor edges can be produced on tools or instruments by lapping.

One of the most interesting of recent lapping developments is the lapping of machine tool bearings. Strictly speaking, the idea is not new, but new lapping compounds have gained the approval of machine tool manufacturers, bearing metal makers, and maintenance men. Irrespective of the composition, type, or size of the bearing, it can be lapped in 75 per cent less time than is required for scraping, and with at least double the effective bearing surface. The fact that properly lapped bearings outlast scraped bearings with better performance is evidence that "charging" does not occur.

Machine Tool Handwheels and Knobs Made from Synthetic Plastic Materials

The accompanying illustration shows handwheels and a knob for operating levers molded from synthetic plastic materials, such as Durez or Bakelite. Made in quantity, such handwheels can be produced cheaply and in practically any color. Knobs and handwheels made from plastic materials are more agreeable to handle than metal ones. A metal bushing with a keyway is molded directly into the hub of the handwheel; and when a handle is required, a bushing, into which the handle may be screwed, is also molded directly in place. The same can be done with knobs to be used on the end of levers. Small handwheels, such as shown to the left in the illustration, can also be made to advantage for operating valves and similar purposes.

One of the difficulties of producing satisfactory inexpensive molded handwheels for machine tools, made from synthetic plastics, is that there is no standard for the size of these handwheels; they vary slightly in dimensions according to the make or type of machine. If the industry could agree upon certain standard outside dimensions of handwheels, it would be possible to mold them in quantities, thereby reducing the price materially. Inserts could be provided to suit each manufacturer's individual needs, so that the studs on which they are mounted would not have to be of standard dimensions.



Handwheels and Knob for Operating Lever Made from Synthetic Plastic Materials

Field of Application of Broaching Machines Broadens

Equipping for the New Needs of Industry
Section 13

VERY rapid progress has been made in the application of broaches and broaching machines. No longer is broaching an unusual operation, confined mainly to the finishing of holes. Broaches are now used in a number of plants for finishing external surfaces, both cylindrical and flat. As one example may be mentioned the wings and wing-shafts for hydraulic automobile shock absorbers. These parts, which are made from steel forgings, are produced at rates up to 600 pieces an hour for each ram of the duplex broaching machine used.

Not only low manufacturing costs, but also great accuracy in the finished product are among the advantages obtained by the use of this method. Special machines have been developed employing the broaching principle for finishing large and sometimes complicated surfaces in a single stroke of the machine.

Vertical hydraulic presses have been constructed for push-broaching, assembling, and general pressing or forcing. Some of these are provided with both foot and hand operation, the foot-treadle control being intended for operating the press on production work.

Broaching Speeds Increased by Development of Automatic Machines

Automatic broaching machines have been developed that increase the speed of broaching operations to a remarkable extent. The operation of one of these machines, typical of many different designs, is as follows: The broach is held at the bottom in a vertical position. The work is placed over the end of the broach shank which projects through the table. Pressure is then applied to a foot-pedal which raises the broach and automatically connects it with the pull-head, after which the broach is pulled up through the work.

At the end of the stroke, the work drops from the broach, sliding off the table into a receptacle. The machine is reversed by means of a hand-lever. When the lower position is reached, the broach is instantly released, allowing it to drop a few inches, which gives it a slight shock and serves to remove the chips. The machine is then ready for a new cycle.

Full-automatic broaching machines are also available. Among work for which they are adapted may be mentioned bushings of seamless steel tubing. These bushings have a hole approximately 1 5/16 inches in diameter and are 5 1/2 inches long. About 0.080 inch of stock is removed on the diameter. The work is fed from a cutting-off machine to a tube on front of the broaching machine which serves as a magazine. By the use of this machine, production has been doubled over the output previously obtained.

Rapid Production of Internal Gears

Internal gears 6 inches in diameter, with a face width of 2 inches, having 30 teeth, are broached at the rate of one every twenty seconds. The teeth of one gear are completed at each pass of the broach. The machine in which they are made is of the hydraulic type and has a capacity of 50 tons. The broach used for the work weighs approximately 440 pounds.

The semi-automatic, pull-type broaching machine shown in Fig. 1 broaches teeth in the forged-steel internal gear shown on the work-table at the rate of 3 pieces a minute. This gear is 4 inches in diameter, 2 inches long, and has teeth 5/32 inch deep. The broached teeth are very smooth and have a high finish.

One of the principal features of another broaching machine is that the work is pulled upward over stationary broaches. One, two, or three broaches can be used. Both rough- and finish-broaching can be performed at the same time. The automatic operation of this machine is obtained hydraulically.

The productive capacity of broaching presses and the possibility of adapting these machines to a wide range of similar products is illustrated in Fig. 2, where a 12-ton broaching press which broaches from 900 to 1000 wrenches an hour is shown. It takes only ten minutes to change the set-up for a different size of wrench. The machine can be arranged either for automatic return or for a full automatic cycle, according to the requirements.

Two-Slide Machine for Taking Rough- and Finish-Broaching Cuts on External Surfaces

The field of broaching has been widened considerably by surface broaching machines equipped with two slides, designed for broaching the outside of work. One slide moves downward while the other

moves up, thus providing a continuous cutting action. Two sizes of these machines are available, the smaller of which is capable of removing 3.3 cubic inches of mild steel per minute, while the larger size can remove 8.6 cubic inches per minute.

Work fixtures opposite each slide move automatically to and from the broaches and can be equipped with hand or automatically operated clamps. The

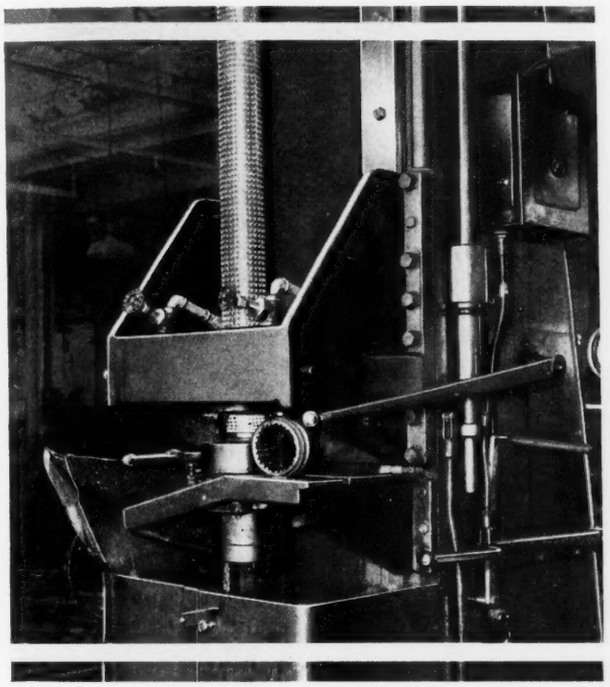


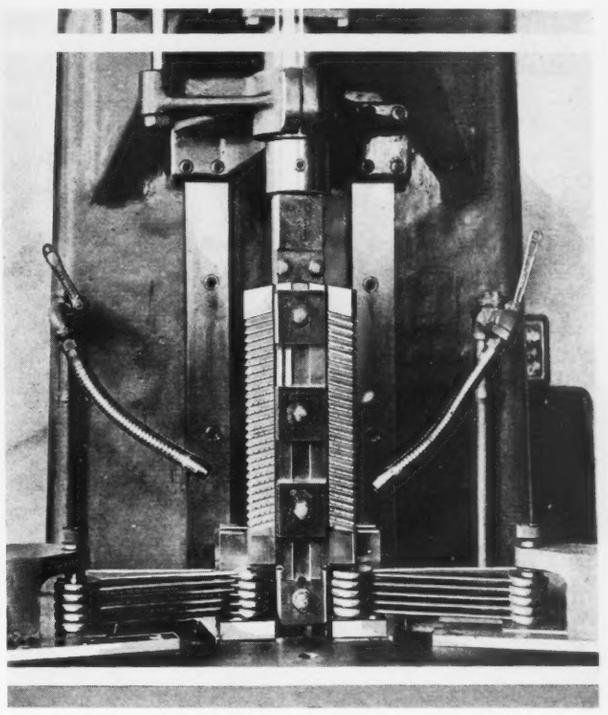
Fig. 1. American Broach & Machine Co.'s Semi-automatic Broaching Machine Engaged in Forming the Teeth in Forged Internal Gears at the Rate of Three a Minute

speed of the machine is limited only by the ability of the operator to reload the fixtures.

Rough, semi-rough, and finish cuts can be taken with each broach. On account of the slow cutting speeds, ranging from 10 to 40 feet per minute, a long broach life is obtained. As many as 50,000 pieces have been broached per grind.

Another interesting development in broaching practice is the "Rotor-Kut" broach by which cored, forged, and pierced holes can be broached from the rough without preliminary drilling, boring, and reaming operations. A single broach takes both roughing and finishing cuts. The cutting or broaching sections are polygonal in shape, and are so arranged around the broach that they are out of alignment with each other. With broaches of this type, holes 1.318 inches in diameter, for example, are finished from a pierced hole 1.150 inches in diameter. Long life, increased production, and reduced cost per hole are the main advantages claimed for broaches of this type when used for work to which this kind of broach is applicable.

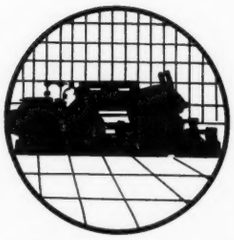
Fig. 2. A 12-ton Broaching Press Built by the Lapointe Machine Tool Co. which has a Capacity for Broaching from 900 to 1000 Complete Wrenches an Hour



Obtaining Best Results in Roll Grinding

A series of articles giving complete directions for roll-grinding operations will be published in coming numbers of MACHINERY beginning with the January issue. This series of articles deals with every aspect of roll-grinding practice, having been prepared by an engineer of broad experience connected with one of the largest grinding-wheel manufacturing companies. The information is based on years of work in collecting the data that will be placed on record. A great variety of roll-grinding operations will be covered, including the grinding of hardened steel rolls, chilled iron rolls, jewelers' rolls, chromium-plated rolls, paper-mill rolls, rubber rolls, steckel-mill rolls, foil rolls, and finishing copper rolls. In each case, specific directions for wheel selection and grinding procedure will be given.

Improved Methods and Alloys Aid Die-Casting Industry to Expand



Equipping for the New Needs of Industry
Section 14

DIE-CASTINGS are taking, and will continue to take, an increasingly important place in industry. The equipment for their production has been vastly improved, and die-casting alloys having remarkable strength and casting qualities have been developed. The steels from which the die-casting dies themselves are made have also been improved to keep pace with the new casting alloys. This progress has resulted in faster production, greater accuracy, and a marked increase in the size of parts made by the die-casting process. The economy of die-castings made in large quantities and to closely held dimensions in dies that are practically indestructible has been definitely established, and there is promise of obtaining similar results on short-run jobs.

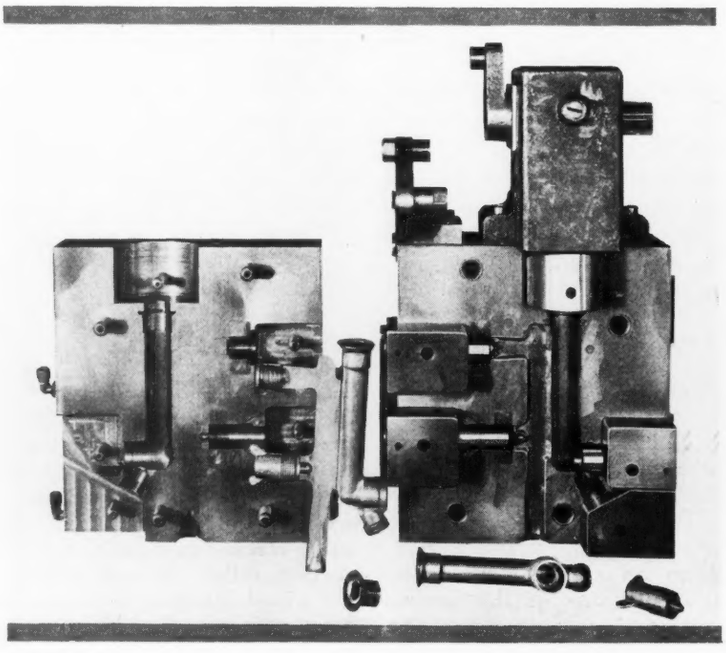
Designers are beginning to understand the die-casting process and to avoid, as far as possible, unnecessary and difficult contours, as well as unnecessarily close tolerances. Almost any dimensional tolerances can be held on die-castings, but the closer the tolerances, the more carefully must the die be made, and the closer must be the inspection of the product.

Manufacturers who have not kept in touch with the new developments in die-casting will be surprised at the savings that are possible by the use of these castings. Parts that could not be made by die-casting a few years ago are now readily produced by this process at a considerable saving. Die-castings of larger size, closer dimensional accuracy, and greatly improved physical properties mark the progress of recent developments in the die-casting field. Aluminum die-castings weighing 18 pounds, with over-all dimensions approximately 33 by 12 by 6 inches, have been produced commercially. With a decrease in over-all width and height, the length may be increased considerably. In fact, die-castings 40 inches long have been produced, while a length of 25 inches is quite common. The section thickness on large die-castings may be as small as 0.090 to 0.100 inch, while in sections less than 6 inches in length or width, the thickness may run as low as 0.040 to 0.045 inch.

Today, commercial aluminum-alloy castings are generally produced within limits of plus or minus 0.0015 inch per linear inch. When the shrinkage of a particular casting is determined by successive trials and reworking of the dies, even closer limits can be maintained on dimensions of 3 inches or more. Dimensions perpendicular to the parting line are maintained within limits of plus 0.010 inch in the largest castings, while on smaller pieces the limits are generally 0 to plus 0.003 inch. For special purposes, however, dimensions have been held to limits of plus or minus 0.001 inch across the parting line.

The draft per inch of depth ranges from 0.015

Fig. 1. Dies for Die-casting Faucet Parts Complete with Threads and Cored Holes (Courtesy, Madison-Kipp Corporation)



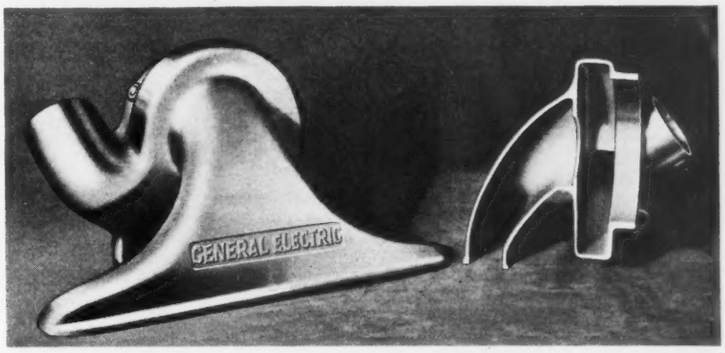


Fig. 2. Vacuum Cleaner Housing and Nozzle Die-cast in One Piece; Shows Successful Handling of Under-cuts and Intricate Forms (Courtesy Precision Castings Co., Inc.)

to 0.020 inch on the diameter for holes less than 1/8 inch in diameter, 0.010 inch for holes 1/8 to 1 inch in diameter, and 0.010 to 0.030 inch for holes over 1 inch in diameter.

The majority of aluminum alloys now used in die-castings are: (1) Aluminum-copper alloys; (2) aluminum-silicon alloys; and (3) aluminum-copper-silicon alloys, with or without additions of nickel or other elements. Aluminum-silicon alloys have advantages as regards casting properties and corrosion resistance over aluminum-copper alloys, but the latter are preferred in some cases for the ease with which they can be machined and for their brighter color. The aluminum-copper-silicon series has been developed to combine the advantages of both alloying elements. Nickel is useful in brightening the color.

Among the most extensively used aluminum die-casting alloys are the A. S. T. M. Nos. 4, 5, 9, and 12. The No. 4 alloy has 5 per cent silicon, with the balance aluminum, and possesses an ultimate tensile strength of 29,000 pounds per square inch and an elongation in 2 inches of 3.5 per cent. The No. 5 alloy has 12 per cent silicon, with the balance aluminum, and an ultimate tensile strength of 33,000 pounds per square inch, with an elongation of 1.5 per cent in 2 inches. The No. 9 aluminum alloy has 4 per cent copper, 1.75 per cent silicon, and 4 per cent nickel, with the balance aluminum. This alloy has a tensile strength of 31,000 pounds per square inch and an elongation of 1.5 per cent in 2 inches. The No. 12 alloy has 8 per cent copper, 1.5 per cent silicon, and the balance aluminum. Its ultimate tensile strength is 33,000 pounds per square inch, and elongation in 2 inches, 1 per cent. The properties given for these four aluminum alloys are the average of data obtained from standard die-cast test specimens.

A great variety of finishing methods are used successfully on aluminum alloy die-castings, including sand-blasting, painting and lacquering, scratch-brushing, bright dipping, ball burnishing, polishing, plating, and oxidizing.

The vacuum cleaner nozzle and fan chamber shown in Fig. 2 represents an important development in the application of cores in die-casting dies. It indicates that the restrictions on die-casting imposed by under-cuts and intricate forms have been practically eliminated. The housing and nozzle shown are the first of these parts to be die-cast in one piece. From the standpoint of intricacy, this die-casting, with its wall thickness of 0.090 inch, is an outstanding achievement. In this case, a saving of approximately 30 per cent was effected by using die-castings in preference to the permanent-mold and sand-cast parts previously employed.

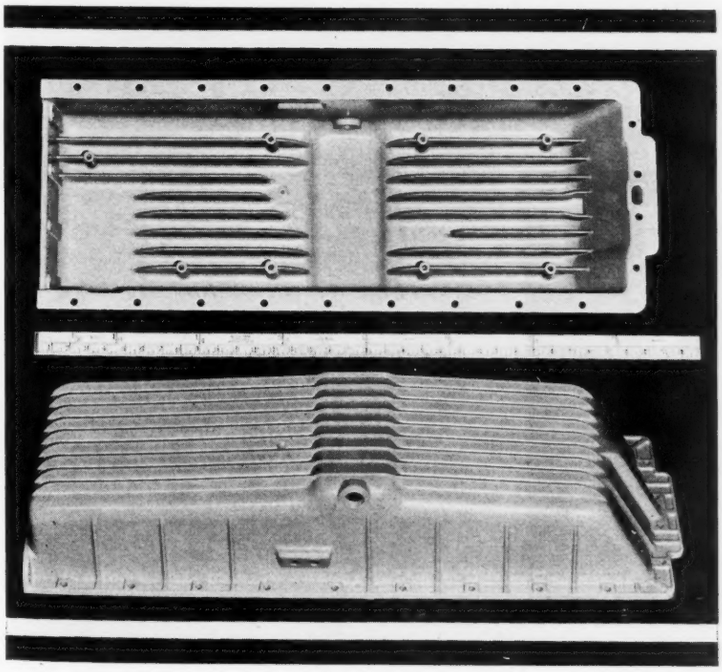


Fig. 3. Aluminum Automobile Oil Base, Believed to be the Largest Die-casting yet Produced (Courtesy, Precision Castings Co., Inc.)

Aluminum Die-Casting of Record-Breaking Size

The aluminum oil base shown in Fig. 3 is believed to be the largest die-casting yet produced, either in the United States or abroad. The die or model for this part weighed 4 tons and was constructed in four weeks at a cost of $6000. The

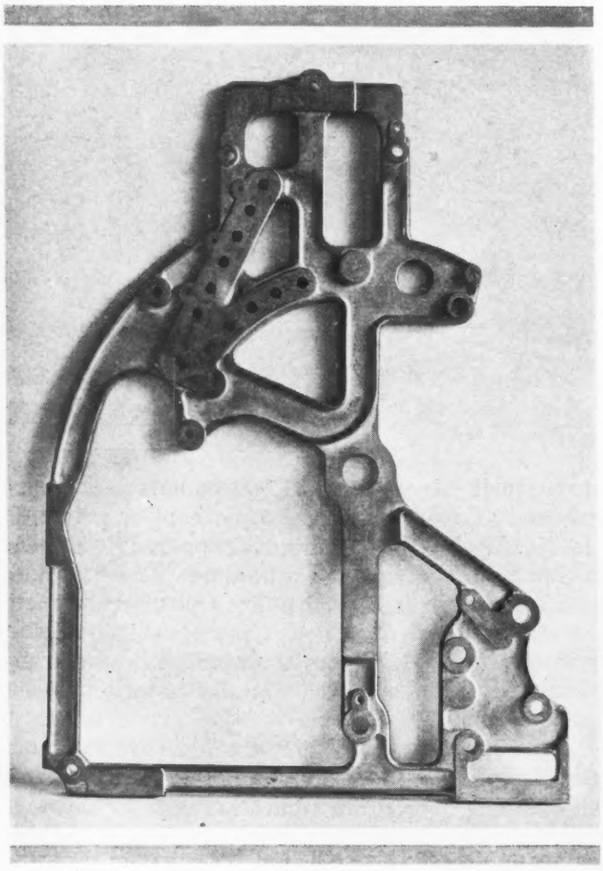


Fig. 4. Doehler Single Die-casting, Approximately 15 Inches Long, that Comprises Entire Side Frame of Ohmer Cash Register (Courtesy, George Gorton Machine Company)

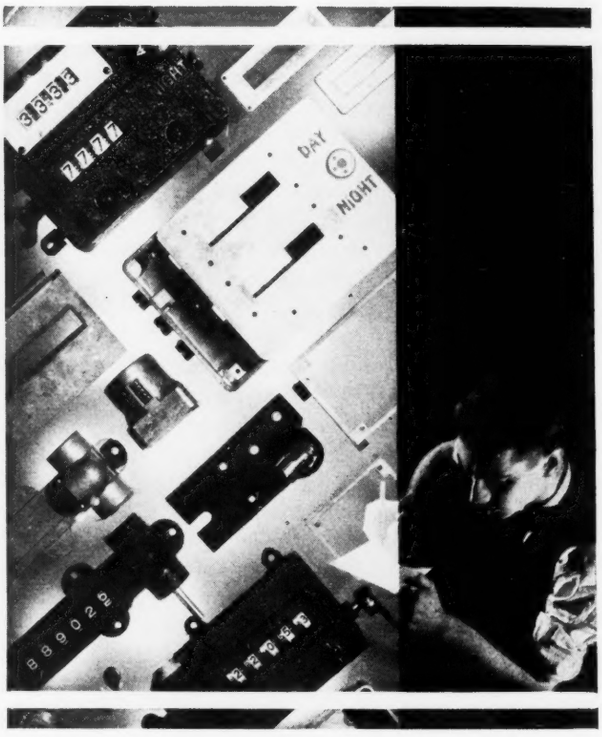


Fig. 5. Veeder-Root Counters — a Typical Example of Die-casting Application (Courtesy, The New Jersey Zinc Co.)

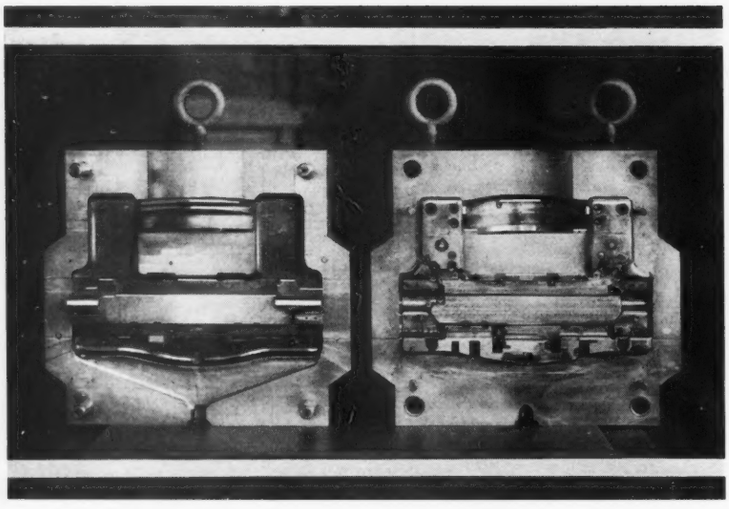


Fig. 6. Dies for Die-casting Typewriter Top Plate, Requiring Accurately Spaced Holes and Locating Surfaces (Courtesy, Madison-Kipp Corporation)

weight of this die-cast oil base is 17 1/2 pounds; length, 34 inches; width, 10 inches; depth, 5 inches. The wall thickness is 0.1 inch. All holes are cast to the finished size. The tapping of some of the holes is the only machine work on this part.

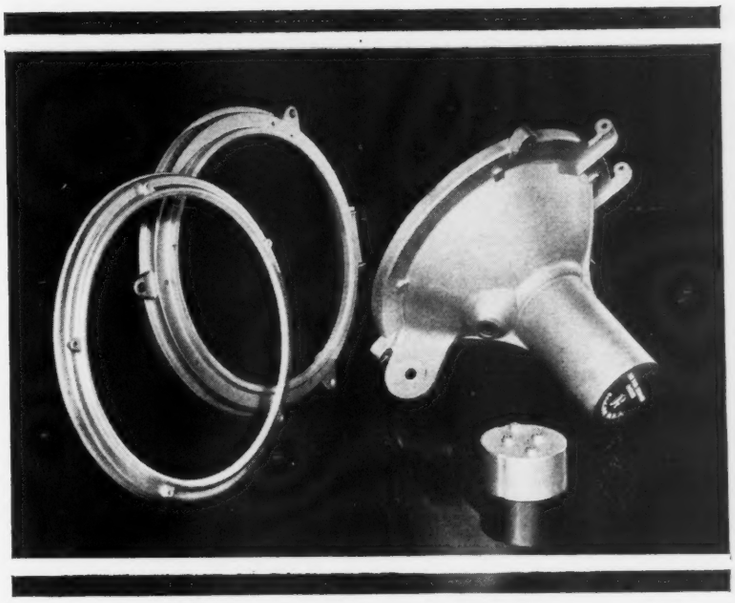


Fig. 7. Aluminum Die-cast Parts for a Floodlight Combine Rigidity, Light Weight, and Resistance to Atmospheric Corrosion with Low Assembly Cost (Courtesy, Aluminum Co. of America)

Developments in the Application of Zinc Die-Castings

It is difficult to trace the developments in zinc die-casting alloys without including the machinery used in the production of die-castings. New zinc alloys, coupled with refined alloying procedure and improved die-casting machines, result in stronger denser castings, with superior surfaces. The most important attributes, however, of the new alloys are permanence of physical properties and of dimensions.

The fields in which zinc die-castings are being used are rapidly expanding. They found early use in the automotive industry, and each succeeding model of almost every car has an increased number of zinc die-castings. The electrical field is continually including more die-castings in new designs. The rotor for a squirrel-cage induction motor is one of the most interesting applications made in this field in the last few years. The assembly of one electric hoist, built in capacities of 1/2, 1, and 2 tons, is now 75 per cent zinc die-cast. In a recently designed lathe, forty-three die-castings are used.

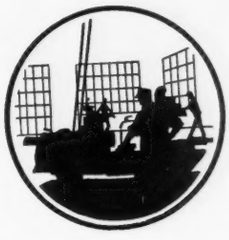
The use of die-cast golf club heads demonstrates the remarkable impact strength of zinc die-castings. Their use for washing machine frames, cowl bar and windshield frames shows their rigidity and their tensile strength.

As an example of the rapidity with which die-castings can be produced, it may be mentioned that small zinc cups, approximately 3/4 inch in diameter by 7/8 inch high, are produced at the rate of 128 per minute in multiple dies, 16 cups being produced each time the molten metal is forced into the dies.

A process has been developed recently by which die-castings of zinc alloys can be held to a predetermined hardness. For example, a spindle made of zinc is held to a B Scale Rockwell hardness of 93 (tested with 1/8-inch diameter ball and 100 kilogram load). Each casting produced has almost exactly this hardness.

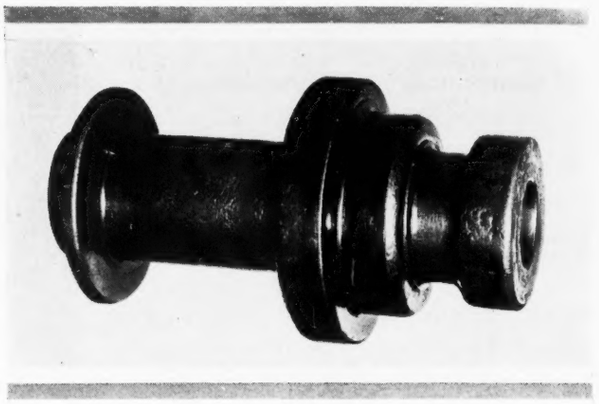
Plating of Die-Castings Facilitated by Improved Methods

Interesting developments in plating and cleaning methods have made it possible to plate zinc die-castings with no more difficulty than parts of other commonly used metals. The technique and solutions employed differ somewhat from those used for plating brass and steel, but the process is no more expensive. Laboratory investigations, supplemented by commercial experience, have resulted in a simplified plating procedure which will produce dense, adherent coatings comparable to those obtained on brass and steel.



Progress in Forging Practice

A Saving in Material and Machining Costs Results from Piercing Accurately Centered Holes in Forgings for Cluster Gears and Similar Work



FORGING dies and the machines on which they are used have been developed to the point where they will produce forgings that require a comparatively small amount of machining. Forgings for automobile cluster gears, like the one shown in the heading illustration, are an outstanding example of advanced practice. The older type forging machines and dies were not adapted for holding work of this kind within the limits of accuracy now maintained.

Besides the saving in machining costs that results from having the work forged to size within closer limits, there is also a considerable saving in material. This is especially noticeable in parts such as shown in Fig. 1, in which the pierced hole is comparatively large. Thus modern forging dies of the internal displacement type, such as shown in Fig. 3, and forging machines constructed as shown in Fig. 4, have brought about savings in material, as well as in machining costs. The operations performed at each consecutive position are indicated by the views of the work in the lower part of Fig. 3.

The forging equipment here illustrated is made by the National Machinery Co., Tiffin, Ohio. The most important features of the forging machine, and the ones that make possible the high degree of accuracy now obtained, are: First, the over-arm heading slide shown in Fig. 4, which permits the use of a short rigid bed; and second, the under-arm gripping slide, which prevents the dies from spread-

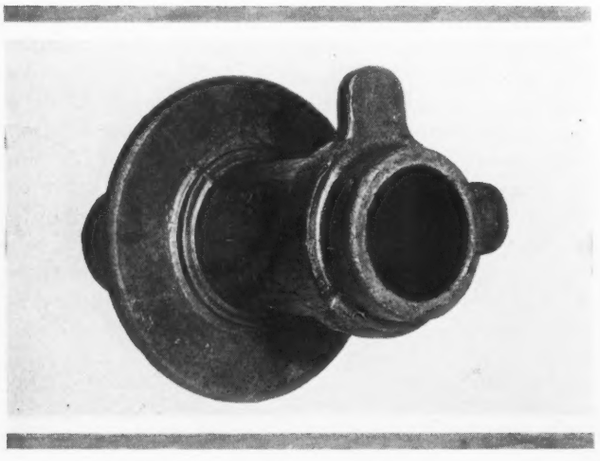
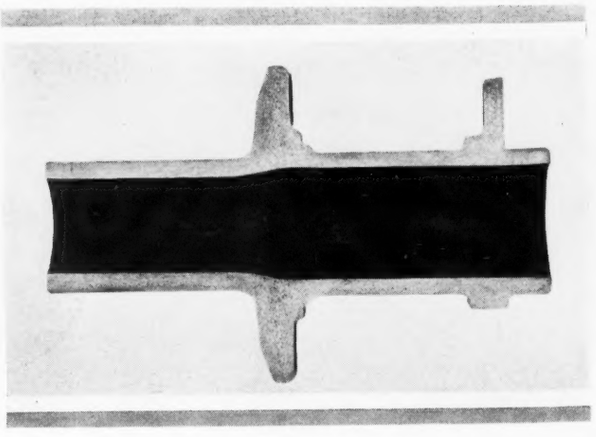


Fig. 1. Piercing Large Concentric Holes in Forgings Instead of Drilling from the Solid is an Accomplishment of Modern Forging Equipment that has Reduced Machining as well as Material Costs

Fig. 2. View Showing Forging Outline and Uniformity in the Thickness of the Walls of the Forging Illustrated in Fig. 1—A Typical Example of Commercial Forging Practice



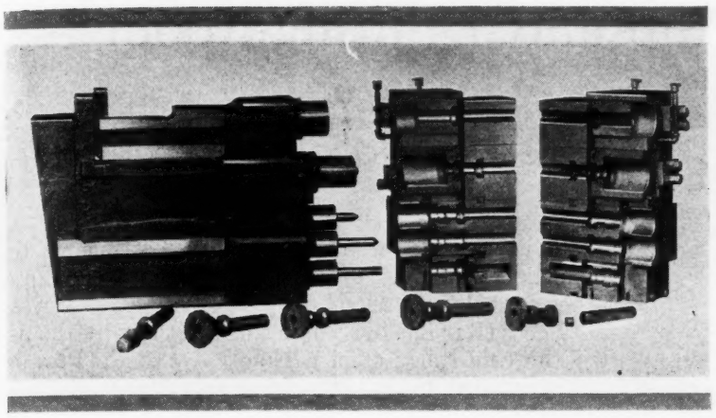


Fig. 3. Dies of Internal Displacement Type Used on Forging Machine Shown in Fig. 4 for Producing Pierced Cluster-gear Forgings

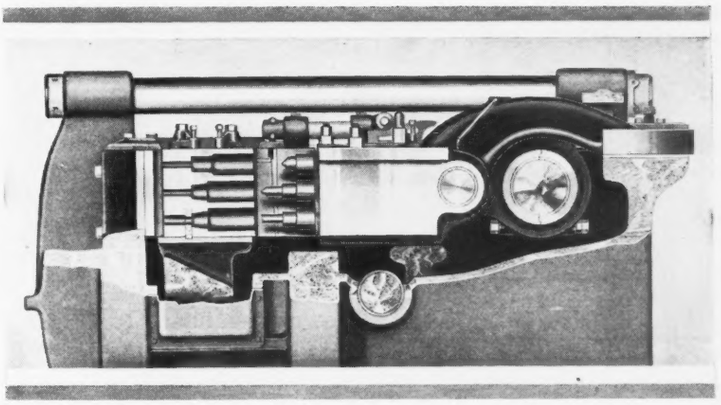
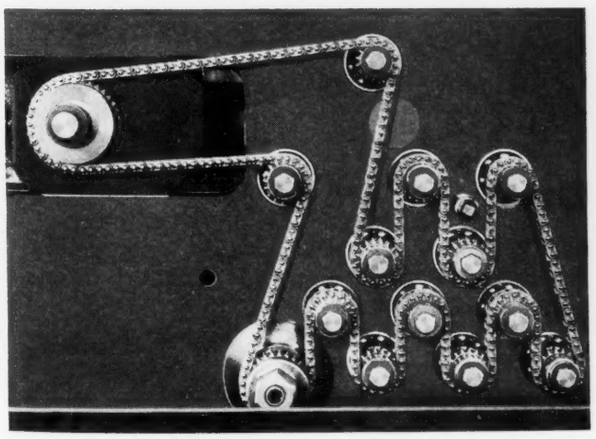


Fig. 4. View Showing Main Operating Members of Forging Machine Built by the National Machinery Co., Having Over-arm Heading Slide and Under-arm Gripping Slide

ing or opening during the forging operation. Both these important features contribute to the accurate alignment required in producing accurate forgings. Many other improvements in forging practice introduced during recent years aid in economical production in every branch of industry.

An Intricate Drive Problem Ingeniously Solved

The accompanying illustration shows a 3/16-inch pitch Link-Belt duplex silent chain drive applied to the driving of thirteen shafts from one driver, involving fourteen chain wheels in all. Twelve of the wheels are 1 1/4 inches in diameter with 21 teeth.



Fourteen Wheels Connected by a Single Link-Belt 3/16-inch Pitch, Duplex Silent Chain Drive

and all the shafts are mounted on a plate 18 inches long by 12 inches high.

The duplex type of silent chain provides tooth-to-tooth contact on either side, and is used when a reverse drive is required on some shaft or shafts, or when adjustment features are desired.

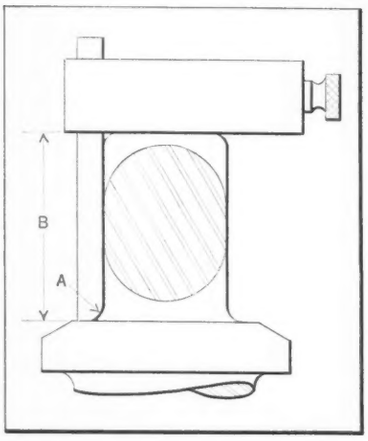
The small-sized silent chain drives recently introduced in industry have found many applications where the power requirements are such that larger chain drives are not necessary. Where the center distances or other design conditions make it impossible or impracticable to use other driving means, the small-sized silent chain frequently offers the best solution of the designer's problem.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

A Combination Fillet and Length Gage

It was required to duplicate the drawing punch shown in the illustration. This punch is of elliptical cross-section, and the shape of the fillet *A* and the length *B* are important. The work was expedited and accuracy assured by making a narrow blade to fit the stock of an adjustable square, one end of the blade being carefully formed to the contour of the desired fillet. In this way an inexpensive gage was obtained for accurately checking both the fillet and the length of the punch; this idea may be applicable to many similar jobs.



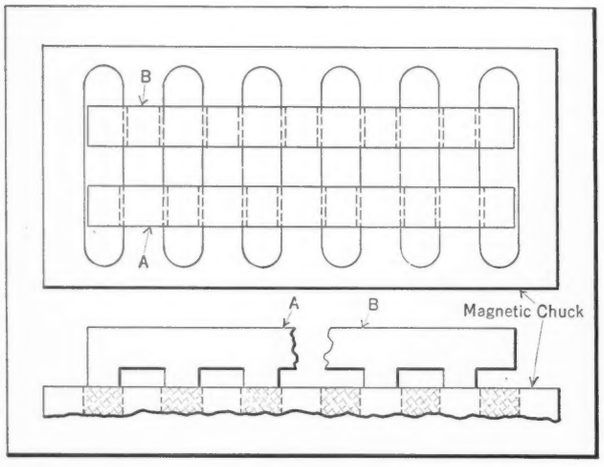
Blade Used in Adjustable Square for Checking the Fillet and Length of an Elliptical Punch

Ontario, Calif. H. R. HAGEMAN

Parallels for Use on Magnetic Chucks

Many grinding jobs done on magnetic chucks are of such nature that parallels are required to support the work. Owing to the fact that a good deal of the magnetic force is lost in passing through the parallels, difficulty is often experienced in holding the work down securely.

The writer has overcome this difficulty by the use of the cold-rolled steel parallels *A* and *B*. Parallel *A* is notched so that it has six legs that rest in the magnetic fields, while parallel *B* has only five legs which rest upon the face of the chuck between the fields. With this arrangement a magnetic field is set up above the parallels. It has been found that with parallels of this type up to 6 inches high, sufficient magnetism is developed to hold the work down securely.

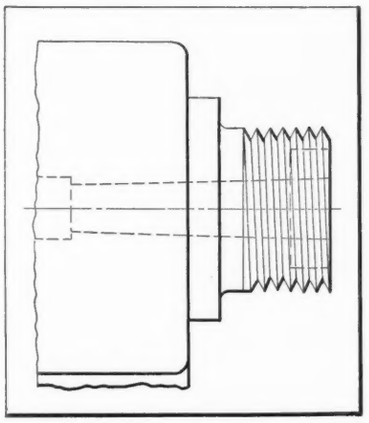


Magnetic Chuck Parallels Notched to Produce a Strong Magnetic Field above their Top Surfaces

West Allis, Wis. WALTER V. SOVITZKY

Repairing Damaged Center Holes in Lathe Spindles

A recent inspection of the machine equipment in the plant where the writer is employed revealed the fact that a number of lathe spindles had been damaged by running the boring tool or drill into the ends of the center holes. Some of the spindles were bored or drilled back as far as 1/2 inch, and it was decided to repair them in such a manner as to prevent a recurrence of this trouble.



Rebushed Lathe Spindle which was Damaged by Boring Tools and Drills

First, the spindles were bored out straight at least 1/2 inch deep and to a diameter large enough for a bushing having a wall 1/4 inch or over. Then bushings were turned from tool steel, hardened and ground on their outer cylindrical surface, and pressed into the bored ends of the spindles. The bushing holes were next finished by grinding to match the taper in the spindle. The grinding was accomplished without dismantling the spindles by the use of an electric toolpost grinder, the compound rest or taper attachment being employed to produce the taper required.

New Britain, Conn. WILLIAM C. BETZ

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

F. C. D.—Toolmakers and diemakers—especially the latter—frequently have to mount two cylindrical parts together, as shown by the cross-sectional view, Fig. 1. This is a common arrangement for punches used in connection with blanking dies. Is there some simple arithmetical method of calculating the amount of metal to be machined off each punch so that the chord on each member will be the same length?

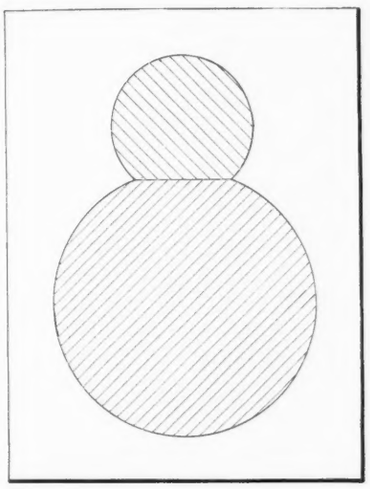


Fig. 1. Adjoining Punches, the Chord Heights of which Must be Calculated

Answered by Emil Wittmann, Philadelphia, Pa.

This is a problem which has vexed many toolmakers and diemakers not equipped with a knowledge of trigonometry. It can, however, be solved by the use of two relatively simple arithmetical formulas. In the diagram Fig. 2, the chord heights x and y represent the depths to which the milling cutter must be set to mill the respective parts. The formulas for obtaining these chord heights were derived as follows:

$$b = (R - x) + (r - y) \qquad (1)$$

According to the laws of geometry,

$$(R - x)^2 + z^2 = R^2 \qquad (2)$$

$$(r - y)^2 + z^2 = r^2 \qquad (3)$$

Subtracting Equation (3) from Equation (2), we have:

$$(R - x)^2 - (r - y)^2 = R^2 - r^2 \qquad (4)$$

Now according to Equation (1),

$$R - x = b - (r - y)$$

Substituting this value of $R - x$ in Equation (4), we have:

$$[b - (r - y)]^2 - (r - y)^2 = R^2 - r^2$$

Simplifying this equation

$$b^2 - 2br + 2by = R^2 - r^2$$

Transposing,

$$b^2 - 2br + r^2 + 2by = R^2$$

But, in the last equation,

$$b^2 - 2br + r^2 = (b - r)^2$$

Hence

$$(b - r)^2 + 2by = R^2$$

and

$$2by = R^2 - (b - r)^2$$

Then,

$$y = \frac{R^2 - (b - r)^2}{2b}$$

Factoring this equation

$$y = \frac{(R + r - b)\ (R - r + b)}{2b} \qquad (5)$$

Now, transposing in Equation (1),

$$x = R + r - b - y \qquad (6)$$

Thus, by first finding the value of y by means of Formula (5), the remaining unknown value x may be found by using Formula (6).

* * *

Textile Machinery Manufactured in 1931

The total number of plants engaged in textile machinery manufacture in the United States in 1931 was 322, employing 17,800 wage earners. The total value of the product was $62,656,000, a decrease of nearly 50 per cent, as compared with 1929 when the total value was $122,438,000. The number of wage earners employed in 1929 was 27,000.

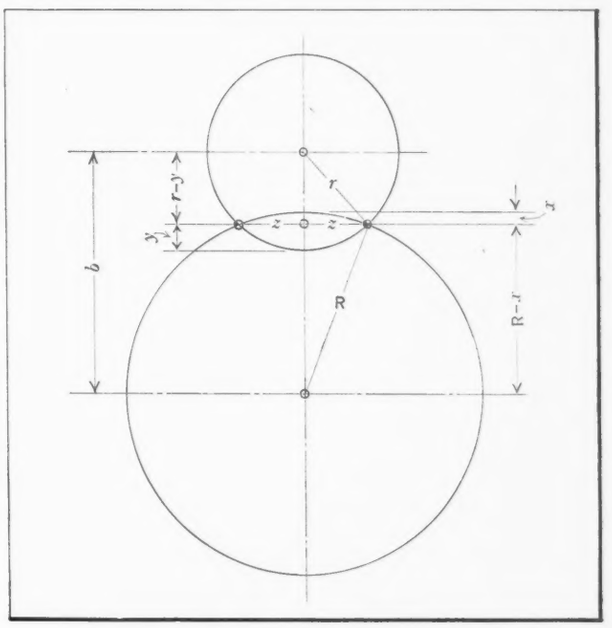


Fig. 2. Diagram Used in Deriving the Formulas for Finding the Chord Heights of the Punches

Cutting Teeth on Tiny Burrs and Formed Milling Cutters

By F. H. MAYOH

THE making of small burrs and formed milling cutters such as are used for jewelers' die-sinking work and for the manufacture of fine tools and instruments requires special equipment. Figs. 1 and 2 show the kind of machine used in milling the teeth in these tiny cutters. The four forms of cutters shown at *A*, *B*, *C*, and *D*, Fig. 1, are examples of the many types of cutters milled on this machine. Another cutter is shown at *X* mounted between the centers *J* and *K*, while at *Z* is a formed arbor of the same shape as the cutter to be milled. This arbor is held between adjustable centers *E* and *F*, so that it can be lined up directly over the cutter *X*. The pin at *G* follows the contour of arbor *Z*, causing the revolving cutter *H* to follow the contour of the work *X* as it is traversed back and forth.

The center *J* can be indexed for spacing the milling teeth by means of the plate *V* and pin *W*. The tailstock center is adjusted by means of a knurled knob (not shown) which operates the same as the tailstock centers used on lathes and milling machines. The dog *M*, in conjunction with screw *N* in the lug of center *J*, holds the work in place while it is revolved for indexing. A knurled knob *P* tightens the sleeve *Q*, into which the center *J* is threaded, so that the center is held securely in spindle *R*, which is free to revolve in its bearing. The spindle is held back against shoulder *S* by the check-nut *T*.

Plate *V* has the required number of holes for indexing the work properly. The entire indexing head arrangement, as a unit, is mounted on a base, as is also the entire tailstock unit. This base, in turn, is set in a pan, as shown in the lower part of Fig. 2, the object being to allow the head and tailstock to be set off center relative to the milling cutter, as required in machining some types of formed cutters. The pan section also serves as a retainer for the chips. The pan terminates in a housing *A*, Fig. 2. To this housing are attached two brackets *B*, one at each end of the machine. The arm *C*,

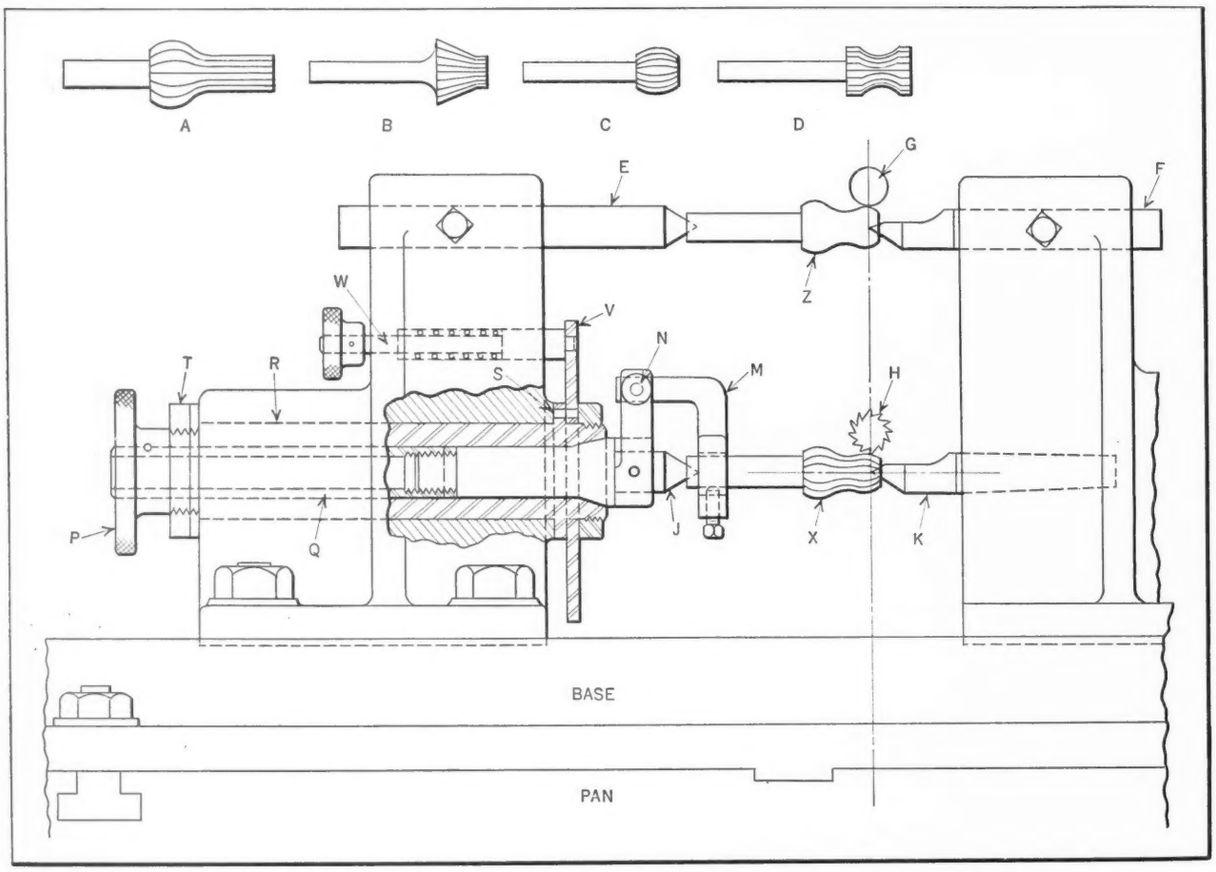


Fig. 1. Indexing Head Used in Cutting Teeth in Small Formed Milling Cutters and Burrs

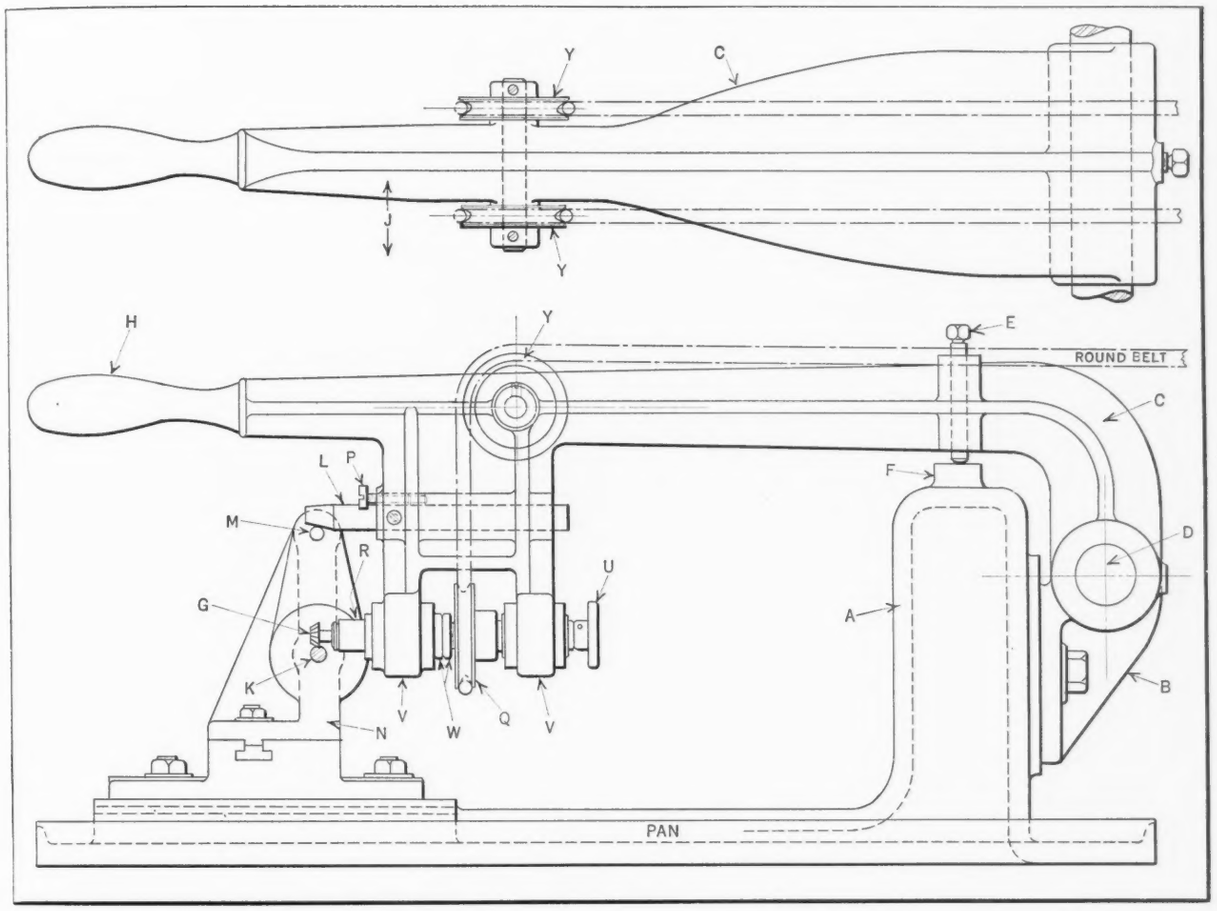


Fig. 2. Belt-driven Cutter-spindle which is Mounted on a Movable Arm Guided by Formed Arbor Z, Fig. 1

supported on a shaft *D*, is free to slide in the brackets *B*. A set-screw *E* and pad *F* locate arm *C*, so that the cutter at *G* will mill the teeth to the correct depth at the smallest diameter of the cutter.

In using the machine, the operator grasps the handle *H* and slides the whole arm *C* crosswise of the machine, as indicated in the plan view by the arrows *J*. Thus the cutter *G* will mill the teeth in work *K* to the required contour, profile, or bevel, as pin *L* follows the outline of arbor *M*. Pin *L* can be moved in or out by screw *P* to vary the depth of the cut slightly.

After one tooth has been milled in the work by moving arm *C* back and forth, the arm is brought to rest, with the screw *E* on boss *F*. The work is then indexed to the correct position for cutting the next tooth by withdrawing pin *W*, Fig. 1, and inserting it in the correct spacing hole in disk *V*. The cutter *G*, Fig. 2, is driven by a round belt running on V-grooved pulleys. Pulley *Q* revolves the spindle *R* in which the draw-back collet is mounted. This collet grips cutter *G* securely when the knob *U* is tightened. The revolving spindle is mounted in tapered bearings *V* of the split type, which are adjusted and secured in place by nuts. The collars *W* are adjusted to prevent endwise movement of the spindle. The round driving belt passes over a pair of idler pulleys *Y*, mounted on a short shaft in arm *C*. The drive is obtained from a large grooved pulley on an overhead countershaft.

The cutters used on this machine are quite small, usually from 1/8 to 1/2 inch in diameter, and it takes but a few seconds to mill one tooth and index the work for milling the next tooth. The weight of arm *C* keeps pin *L* in contact with the formed arbor *M* or the arbor *Z*, Fig. 1. The brackets *B*, Fig. 2, are set wide apart, so that shaft *D* can slide easily.

This example of special equipment shows particularly well the comparatively simple type of construction possible when light work is handled.

* * *

Smallest Ball Bearing Manufactured

In November MACHINERY, page 217, it was stated that a bearing 1/2 inch outside diameter was believed to be the smallest ball bearing manufactured. We are informed that this statement is in error. The Norma-Hoffmann Bearings Corporation, Stamford, Conn., has, for some time, made a bearing which is only 3/8 inch outside diameter and has a 1/8-inch bore. This bearing is, we understand, the smallest regularly listed ball bearing manufactured. It is listed in the catalogue of the Norma-Hoffmann Bearings Corporation.

Materials Used for Cutting Tools in Present-Day Shop Practice*

General Principles on which to Base Selection of Cutting Materials to Suit Requirements

By J. V. EMMONS, Metallurgist
Cleveland Twist Drill Co., Cleveland, Ohio

THE great variety of cutting materials now in use is indicative of the complex nature of the property known as "cutting quality." Some of the new materials give remarkable results on certain classes of work, while many of the older ones still prove the most economical for equally important work of other classes. In fact, practically every good cutting material ever produced appears to have its special field of usefulness, while no one material yet developed meets all requirements. Thus the problem of selecting the right cutting material for each job has become somewhat complicated, especially in view of the rapidly increasing number of substances or materials used in modern industry.

Characteristics and Practical Value of Carbon Tool Steels

Materials for cutting tools may be generally divided into ferrous—steels—and non-ferrous, including diamonds, most abrasives, and the hard metal-cutting alloys.

Up to thirty years ago, carbon steel was the standard cutting-tool material; and, in spite of the multitude of new cutting materials, it still has a wide field of usefulness. Some of its most valuable attributes are great hardness; toughness, especially under shock; ease of fabrication; easily varied degree of hardness or temper; and low cost.

This steel is deservedly popular for hand tools, tools subject to severe shock, and tools that encounter only low operating temperatures. Its low cost renders it economical for tools that are used only occasionally, particularly when relatively few parts are machined. Examples of tools for which it is still widely used are hand reamers, bit stock drills, blacksmith drills, small wire-size drills, hand taps and thread-cutting dies, numerous tools used in working wood, brass, aluminum, lead, zinc, and similar easily machined metals and alloys.

Carbon Tool Steels that Have Been Improved by Alloying

Commercial carbon tool steels now on the market frequently contain alloying elements such as chromium and vanadium. These metals, even when present in amounts of less than 0.50 per cent, may impart valuable properties to the steel. Many of the carbon tool steels of today contain about 0.15 per cent chromium.

Steel containing about 0.50 per cent chromium has been deservedly popular for cutting tools, on account of the fact that it will harden uniformly to a great depth. Tools produced from this steel are still commonly known as carbon-steel tools. Commercial carbon-steel drills in sizes larger than 1 inch in diameter are largely made from this grade of steel.

Alloying elements such as chromium, tungsten, molybdenum, and manganese, in amounts of 1 per cent or higher, are frequently added to carbon steel. Sometimes this is done in order to increase the cutting quality, and sometimes to make the steel oil-hardening. Commercial tools made from such steel, to be sold from stock, are usually marketed as "carbon" tools or, perhaps, as "super-carbon" tools, as, in general, the market for stock cutting tools only recognizes the two classifications—"carbon-steel tools" and "high-speed steel tools."

Sometimes tools made from the type of steel containing about 1 per cent tungsten have been marketed as "semi-high-speed steel tools." The sparks obtained from grinding these steels are about half as red as those from high-speed steel. This appears to be the only resemblance they have to high-speed steels.

The grade of tool steel containing from 1 to 1.50 per cent chromium has attained a wide usefulness in many fields. It is oil-hardening, and develops a good degree of hardness and excellent toughness, together with a high resistance to wear. An unusually wide range of useful properties can be imparted to it by variations in heat-treatment. Its ease of fabrication and its low cost also contribute to its popularity.

The grade of steel containing from 1 to 1.50 per cent of manganese is oil-hardening, and is frequently used for intricate tools when there is great danger of warping or fire-cracking during the hardening operation. It has been particularly popular for die work and forming tools.

Examples of "Intermediate" Alloy Steels

Steels of higher alloy content than the tool steels previously considered have been used for special requirements. Good examples are the 4 per cent tungsten, 1 per cent chromium steel used for fine finishing tools that take only light cuts and also as a die steel where great resistance to wear under low operating temperatures is required. Some makers

*Abstract of a paper presented before a recent meeting of the American Society of Mechanical Engineers.

also add small amounts of vanadium to this steel. Molybdenum steels have been used to some extent in the field between carbon and high-speed steels. Such tools seem to be limited to very special uses.

A recently introduced type of die steel contains about 12 per cent chromium and 2 per cent carbon, with sometimes minor additions of vanadium or molybdenum. Such steels are used when great resistance to wear is desired, and have been found to be quite resistant to high operating temperatures and to oxidizing influences. As indicated by its analysis, this type of steel is closely allied to the stainless steels.

Properties of High-Speed Steels

One of the most prominent of the high-speed steels so widely used for production tools is the 18 per cent tungsten, 4 per cent chromium, and 1 per cent vanadium steel. This so-called "18-4-1" high-speed steel is used extensively for commercial high-speed steel tools. Its advantage over carbon or low-alloy tool steels is its ability to maintain its hardness, strength, and cutting quality at high operating temperatures. Carbon-steel tools begin to lose their hardness and strength at about 500 degrees F., whereas high-speed steel tools maintain a high degree of hardness and strength at operating temperatures of 1100 degrees F., which is a low red heat. When operating temperatures of 400 degrees F. are not exceeded, there is usually very little advantage in using high-speed steel instead of carbon steel.

While an increasing amount of high-speed steel has been used for production tools by the mechanical industry ever since the introduction of this steel, the change from carbon to high-speed steel tools was unavoidably slow, because of the necessity of redesigning practically all machine tools to suit the speeds and feeds employed for the high-speed tools.

Several other types of high-speed steels are on the market. One containing 14 per cent tungsten, 4 per cent chromium, and 2 per cent vanadium, has excellent cutting properties, but is handicapped by having such a narrow hardening range that extremely accurate heat-treatment is necessary. A type containing about 15 per cent tungsten, 4 per cent chromium, and 0.50 per cent vanadium is quite popular in England. There are also some European steels that contain as high a tungsten content as 20 to 23 per cent, but these have never been greatly favored in this country.

Many attempts have been made and are still being made to improve the composition of the 18-4-1 type of steel. Much of the popularity enjoyed by this steel appears to be due to its general utility. It has a fairly wide range of temperatures in which heat-treatments can be satisfactorily conducted.

The carbon content can be varied over a considerable range, in order to secure steels specially fitted for particular uses. For instance, steel with a carbon content of 0.40 to 0.50 per cent is used in dies for hot work. Steel with 0.70 to 0.80 per cent carbon is used when a high degree of hardness is required and a high degree of toughness is not essential.

Recent Efforts to Improve Cutting Steels

Efforts have been made to produce a super high-speed steel by increasing the percentages of essential alloys, such as tungsten, chromium, and vanadium, but such steels have not obtained wide commercial use. Efforts have also been made to improve high-speed steels by the addition of small quantities of such materials as uranium and tantalum, but the effect of such additions is not yet fully understood.

The use of cobalt as an additional alloy in high-speed steels of the general 18-4-1 composition has increased within the last few years. Steels containing from 4 to 12 per cent cobalt are now a commercial product, and steels having still higher percentages of cobalt have been tried experimentally. A certain degree of popularity has been achieved by this type of steel, particularly for lathe tools and tool bits. Its demonstrated advantages are first, a certain increase in hardness, which is, however, attained at the expense of some of the toughness; and second, a widening of the range of temperatures in which satisfactory hardening can be obtained. The cobalt makes the steel less likely to be damaged by over-heating or under-heating in hardening. Such tools have the required degree of strength and hardness at any drawing temperature up to 1100 degrees F.

Some steel makers add about 1 per cent of molybdenum to 18-4-1 steels, especially if they contain cobalt, but the purpose of this addition or the results obtained from it are not very clear. Other cobalt high-speed steels have the 14-4-2 type of composition as a basis. In these steels, cobalt widens the hardening range so that tools made from them can be uniformly heat-treated by ordinary commercial practice.

The possibility of making high-speed steels in which molybdenum is used as the principal alloying constituent has long been known. No such steels have yet achieved commercial utilization to any considerable degree, but recent efforts to overcome the disadvantages that have handicapped these steels in the past have shown some promise.

Non-Ferrous Cutting-Tool Materials

The most widely used non-ferrous materials for cutting metal are the artificial abrasives, such as aluminum oxide and silicon carbide employed in grinding wheels. Wheels of these materials have made it possible to shape materials and substances that are so hard that they were previously considered unmachineable. Abrasive grains carried by a powerful air blast have also obtained such efficiency that they are entitled to at least passing mention as a cutting tool.

The diamond, as the hardest known material, has a notable degree of usefulness as a cutting tool. Its particular field lies in the machining of substances that are so hard or abrasive as to be practically unmachineable by other cutting tools. Its largest field is doubtless that of turning and resurfacing abrasive wheels. A highly specialized but indispensable field for the diamond is the lapping of other materials of extreme hardness.

In the class of non-ferrous cutting tools are the "hard metal alloys." The cobalt-chromium-tungsten alloy known as Stellite has been in commercial use as a cutting tool for many years. This alloy must be cast and then ground to its finished shape. Its principal property is the ability to retain hardness at a high temperature, probably several hundred degrees higher than ordinary high-speed steel.

Developments in Tungsten and Tantalum Carbide

The recent developments in tungsten and tantalum carbide cutting materials have excited much interest. In machining abrasive materials of low strength, such as graphite, hard rubber, slate, asbestos compositions, etc., the ability of these cutting materials to withstand wear is phenomenal. They have also been quite successful in machining ferrous materials, particularly cast iron. Annealed tool steel, on the other hand, is an example of a material that has been found difficult to cut economically with carbide tools; annealed high-speed steel, in particular, exerts a severe wearing action upon carbide tools. It has been shown, however, that carbide tools will withstand higher operating temperatures than those made of any other metallic material. The lack of toughness, however, has proved a serious limitation.

Nitrided cases and chromium plate have also been proposed for hardening the surfaces of cutting tools to enable them better to resist abrasion.

Possibilities in Future Developments of Tool Materials

It is difficult to predict what the future will bring forth in the line of cutting materials. There are, however, certain trends that seem likely to continue. There is also much experimental work in progress, some of which is approaching the stage of commercialization. It may be confidently expected that the near future will bring forth tool steels which are better than those now in use, as well as some that are cheaper. Indeed the simultaneous achievement of increase in quality and decrease in price is entirely within the bounds of possibility.

The field of the non-ferrous hard metal alloys has been but little explored, and there are many possibilities of valuable additions to our available tool materials from this source. The utilization of the carbides as tool materials has advanced so rapidly that further improvements in quality and reductions in the cost of production seem probable.

It seems unlikely that any single tool material will succeed in dominating the entire field of cutting tools; it is more probable that the future will see an increasing number of useful materials, each filling a specialized need.

Meeting of the Acetylene Association

At the meeting of the International Acetylene Association held in Philadelphia, November 16 to 18, an unusual number of papers of value and interest to the welding industry were presented, covering almost every phase of gas welding, both from the technical and the commercial side. The application of oxy-acetylene welding to piping, central heating and power plants, aircraft, railroad work, the building of automotive equipment, and the steel industry were dealt with at different sessions. One paper dealt specifically with the use of welding and cutting in plant maintenance, while the training of journeymen welders received attention in another. A whole session was given over to the metallurgical phases of the oxy-acetylene process, including the testing of welds.

A unique session included the presentation of an industrial drama in three acts, portraying vividly the technical and practical factors of plant rehabilitation in the industrial field. A cast of men well known in engineering aided in the performance, the object of which was to emphasize the technical soundness of the rehabilitation program.

One of the features of the meeting was the announcement of the award of the Morehead Medal for 1931 to Gustaf Dalen of Stockholm, Sweden. Mr. Dalen, a pioneer in the acetylene industry, is the inventor of the acetylene light-flashing device used on marine buoys and beacons, and of the "sun valve," a device that shuts off the supply of gas during daylight hours. He has also contributed greatly in many other ways to the advancement of the acetylene industry. His distinguished service in the engineering field has been previously recognized by the award of the internationally known Nobel Prize.

The Morehead Medal is awarded annually by the International Acetylene Association to the person who, in the judgment of the officers and board of directors of the Association, has done most to advance the industry or the art of producing or utilizing calcium carbide or its derivatives.

* * *

The greatest safety appliance of all is the human mind.—*News Letter, National Safety Council.*

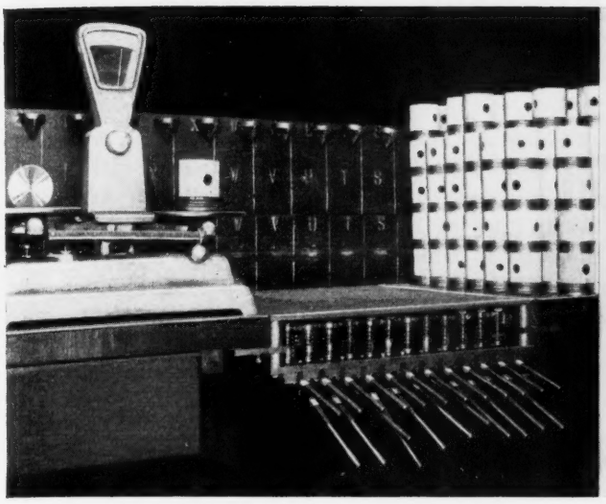


Fig. 1. Marking Machine and Weighing Scale. After Each Piston is Weighed, it is Placed on the Stamping Table and the Weight Marked on it by Lifting a Lever

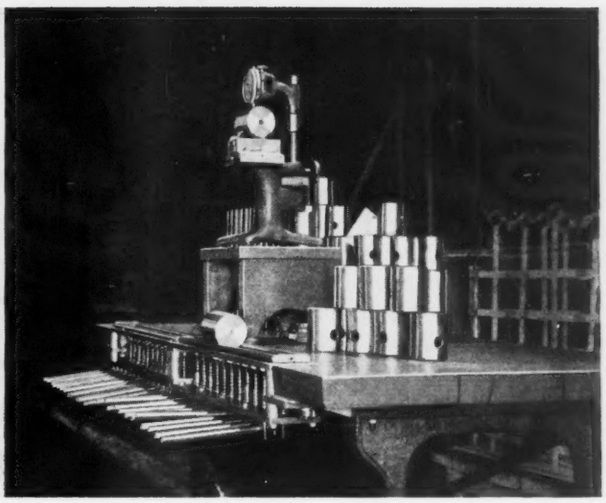


Fig. 2. Arrangement for Stamping Sizes on the Pistons. The Piston, after Leaving the Comparator, Rests on Two Bars which Straddle the Lever-operated Stamps

Weighing and Marking Automobile Pistons

Combination of Weighing Scales, Measuring Devices and Marking Machines for Grouping Pistons of Similar Weight and Size

By A. W. DILTS, Inspection Department
Studebaker Corporation, South Bend, Ind.

IN the manufacture of automobile engines, it is essential that all the pistons in each engine be of the same weight. To facilitate assembly, their diameters must also be uniform. On account of manufacturing conditions, however, the weights and diameters of these pistons, as they come from the machining line, although held to close manufacturing tolerances, vary sufficiently to cause unbalance and difficulty in assembling. To overcome these difficulties, one large automobile concern has inaugurated a system of grouping the pistons according to their weight and diameter. Special equipment is provided for rapidly marking the weight and size on each piston, so that pistons of the same size and weight can be selected from stock for assembly.

The machine for marking the weight on the pistons is shown at the right in Fig. 1. Adjacent to the machine is a weighing scale. There are twenty-three handles of the trigger type projecting from the machine, each of which operates a different stamp. The working end of the stamps is normally flush with the top of the machine table which supports the pistons. Each stamp is mounted in a spring-actuated plunger, and when the plunger is operated by lifting the proper handle, the stamp is brought into contact with the piston and the letter designating the weight stamped on it. Tags with corresponding letters are attached to each handle. This is for the convenience of inexperienced operators, but after a little practice, the handles are found by the sense of touch, the same as on a typewriter.

The operator first places a piston on the scale, which is graduated in letters corresponding to the stamps on the machine. As the balance comes to rest, he notes the letter opposite the pointer, and removing the piston with his right hand, places it on

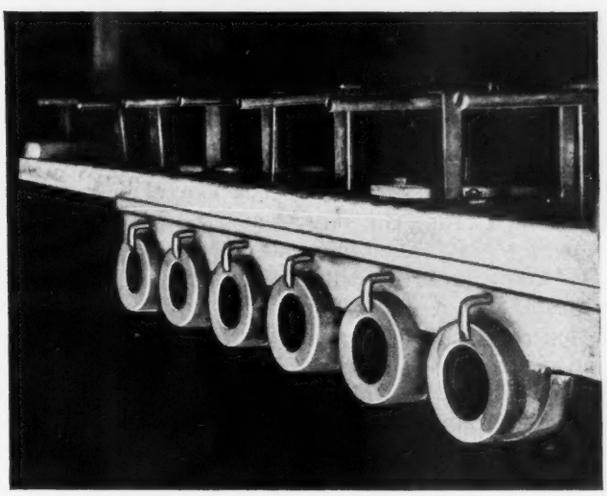


Fig. 3. The Pistons are Checked by Size Rings and Marked by Lever-operated Stamps at the Rear of the Rings

the machine over the proper stamp. While doing this, with his left hand he places another piston on the scale, and with his right hand lifts the lever to stamp the weight on the piston. The handle and stamp return automatically to their original positions when released. The piston does not leave the operator's hand from the time it is taken from the balance until it is in position to be marked, thus avoiding errors in marking.

For sizing the pistons a similar machine is employed. In this case, a comparator is used instead of a scale, as shown in Fig. 2. Each piston is checked and then marked by laying it in position on two guide bars. The proper handle is then lifted to stamp the size on the relieved portion of the piston near the wrist-pin hole. This arrangement is also used for checking the pistons after tinning to insure the proper thickness of tin.

Certain types of aluminum pistons are marked for size by first passing them through sizing rings. This arrangement is shown in Fig. 3. A series of rings varying in size is provided, and directly behind each ring is a stamp operated by a handle in the same manner as in Figs. 1 and 2. The operator first finds the ring that the piston fits correctly, and passes the piston through, laying it upon the stamp at the rear. He then lifts the lever and stamps the size on the piston.

Robertson Recommends Broader Study of Economics

Speaking to the student body, trustees, and faculty of Allegheny College recently, A. W. Robertson, chairman of the board of the Westinghouse Electric & Mfg. Co., stressed the need for a scientific or laboratory approach to the solution of the nation's economic problems. Likening business depressions to visitations of typhoid fever and other epidemics that have been cured by study, Mr. Robertson called upon the college graduate and the man of education generally to seek cures for business slumps.

He ascribed their recurrence to ignorance of basic economic principles. "We suffer from this depression," said Mr. Robertson, "because our attitude of mind toward our economic and business problems is wrong. We know little about economics or business. We spend all our time in improving, perfecting, and marketing marvelous devices and machines, but little or no time in the study of the basic factors governing our economic, social, and political life.

"It is stupid to suffer as the world has suffered recently and will suffer for months to come. It is probably as stupid as the old epidemics, before we learned the cause of typhoid fever and applied the necessary cure to end typhoid epidemics in civilized society for all time.

"We must apply the same attitude of mind, the same zeal for cure shown by the medical heroes in solving the problems of disease epidemics, to the solution of our economic ills. A solution must be found, and will be found, somehow.. The solution, when discovered, will probably be as different from the recommended cures of today as the present methods of preventing typhoid are from the old ineffective practices. Our present-day economic cures are, of course, the best we know in our present ignorance. . . .

"The approach to the solution must be the scientific approach, the open-minded search for a true answer. The searcher must have the heroic zeal of the doctors who searched for and found in their laboratories and in dangerous experiments the way to control and cure pestilence and disease. The searcher for economic truth must be on fire with a desire to abolish the ravages of depression. He must hate these visitations of business prostration, with their attendant human suffering, as the pioneers in medical discovery loathed typhoid, yellow fever, and the other scourges that they sought to conquer.

"We, as citizens of a great nation, must cultivate an attitude of mind that will stimulate such searching for economic truth. We cannot expect our civilization to endure any more than former civilizations endured, unless we find the cure for the economic diseases that threaten its very life."

* * *

Converting Inches to Millimeters

An American Standard value to be used by industry in converting inches to millimeters was recommended by a general conference held under the auspices of the American Standards Association on October 21, following a request of the Ford Motor Co. Representatives of eighteen industrial groups having an interest in precise measurements and methods of limit gaging were present. The Conference unanimously recommended the conversion factor of 1 inch = 25.4 millimeters to become the American Standard value for industrial use, replacing for this purpose both the official ratio 25.40005 and the rounded value 25.4001 given in certain handbooks and tables.

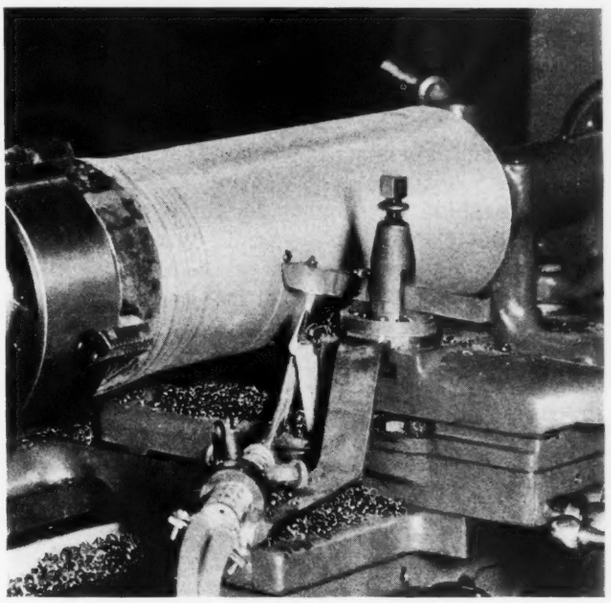
The official British ratio is 25.399978, and the last precise experimentally determined value 25.399956. Thus the British official value is about one part in a million below, and the American official value about two parts in a million above, 25.4. British industry, through the British Standards Institution, adopted the value 25.4 for industrial use in 1930.

The recommendation adopted by the conference will be sent by the American Standards Association to all the industrial groups concerned for written acceptance before final approval.

A Demonstration of J-Metal Tools

One of the most spectacular demonstrations at the recent Metal Exposition in Buffalo was a red-hot cutting tool in actual operation. The demonstration was intended to show the property of red hardness of Stellite J-Metal, a non-ferrous cutting alloy consisting of cobalt, chromium, and tungsten.

The illustration shows the set-up; the material machined was a steel billet 5 inches in diameter and 16 inches long, containing from 0.15 to 0.20 per cent carbon and 0.30 to 0.60 per cent manganese. The depth of cut was 0.025 inch; the feed, 0.004 inch; and the surface speed 130 feet per minute. A 0.4- by 0.5-inch solid Stellite J-Metal tool was mounted in the toolholder with approximately a 2-inch overhang. An oxy-acetylene welding blowpipe was adjusted so as to direct a flame on the bottom edge of the tool, 1 inch from the end. In this manner, the cutting end of the tool was kept constantly at a red heat of approximately 1375 to 1475 degrees F. A small portion of the alloy near the hottest zone of the flame was actually melted.



A Stellite J-Metal Tool Heated to a Red Heat by an Oxy-acetylene Flame. The Tool Cut Continuously for Sixteen Hours Without Redressing

After sixteen hours of continuous cutting, the tool was removed, cleaned up with a stone, and put into service again. The cutting edge of the tool was in good condition, and could have cut longer without any attention—a good indication of the durability of the tool.

* * *

Standardization of Machined Surfaces According to Quality of Finish

At 9.30 A.M., December 9, a meeting will be held at the Engineering Societies Building, 29 W. 39th St., New York City, to organize a committee on standardization and designation of surface qualities, including standards of quality of machined and ground surfaces, methods of inspection for quality, grades standardized, and grade designations for specifications and drawings. The committee will be composed of representatives of organizations and of individuals interested in the subject of machined surfaces.

In order that this project may be developed along the lines most useful to industry as a whole, it is to be hoped that all those interested in the subject will be present. The American Standards Association has assigned this project to the joint sponsorship of the Society of Automotive Engineers and the American Society of Mechanical Engineers.

* * *

Rehabilitation Work in Connecticut

The national Share-the-Work and Industrial Rehabilitation committees in Bridgeport, Conn., have been consolidated in an effort to make the committees' work more effective by joint activity. The joint committee includes W. G. Carey, Jr., vice-president of the Yale & Towne Mfg. Co.; Colonel Leonard S. Horner, vice-president, Bullard Co.; Robert M. Eames, manager, Bryant Electric Co.; H. Almon Chaffee, vice-president, A. W. Burritt Co.; and George S. Hawley, president, Bridgeport Gas Light Co.

The industrial rehabilitation program calls for a buying campaign on the part of manufacturers to put their plant equipment in first-class condition. The share-the-work project has to do with the distribution of work among employes. Both problems, however, are manufacturing problems and have to be dealt with by the same executives. Hence, it is logical to have the two committees consolidated. Members of the committee are interviewing local manufacturers to obtain their cooperation in the replacement of old equipment and in the sharing of employment.

The advantages of installing new machinery at the present time, when this can be done on a sound economical basis, are threefold: First, modernizing will keep a company in a satisfactory competitive condition, because it is possible to operate profitably at a lower cost; second, materials and equipment can be purchased now at a lower price than that which will prevail when business recovers; and, third, improvements can be made now without interfering much with plant operation.

* * *

There is a principle that prevents discussion, bars progress, and keeps one in everlasting ignorance all the days of one's life: That principle is condemnation without investigation.—*Herbert Spencer*

Annual Meeting of the Mechanical Engineers

TWO noted leaders of American industry are on the program of the annual meeting of the American Society of Mechanical Engineers, which will be held in New York City December 5 to 9. General James G. Harbord, chairman of the board of the Radio Corporation of America, will be the speaker at the Society's annual dinner at the Hotel Astor on December 7, and A. W. Robertson, chairman of the board of the Westinghouse Electric & Mfg. Co., will deliver the Towne memorial lecture on the relation of economics and engineering, Thursday, December 8. Mr. Robertson is chairman, by appointment of President Hoover, of the newly established Committee on Rehabilitation of Industry. In addition, a remarkable technical program will be presented at the meeting.

At the machine shop sessions, several papers will be presented on the cutting of metals. Two papers will deal with the new cemented-carbide cutting tools. One of these is entitled "What Can be Accomplished with Modern Machine Tools and Cemented-carbide Cutting Tools," by A. A. Merry; and the other, "Grinding Cemented Tungsten- and Tantalum-carbide Tipped Tools Efficiently and Economically," by J. M. Highducheck. Other papers of general interest to the machine shop industry treat of special steels for castings, and malleable iron as a component part of machines.

A paper of general interest to all engaged in industry will be L. P. Alford's review of "Ten Years' Progress in Management" (briefly abstracted below). In this paper, Mr. Alford covers the subject in a very comprehensive manner. Educational training for the industries will also be given adequate attention at the meeting, three papers on the subject being scheduled, dealing with various phases of this work.

In a paper to be presented by Carle M. Bigelow, on "Management Essentials for Recovery," the author gives the following management procedure necessary to bring about a general recovery of sound business conditions: 1. Determine product characteristics from the consumer's viewpoint. 2. Determine the volume that can be absorbed by economic distribution efforts. 3. Organize the production facilities to produce this volume. 4. Consider this volume as normal, and meet increased demands by over-time or additional regular hours of labor. 5. Measure all efforts of personnel and compensate them in terms of their contribution to the ultimate profitableness of the business. 6. Put aside, for all time, the "volume complex." 7. Consider maintenance of employment, building up strong cash reserves, and adequate research just as essential as insurance. 8. Develop a spirit of cooperation within each industry rather than competition.

Ten Years' Progress in Management

At the annual meeting of the American Society of Mechanical Engineers to be held in New York during the week beginning December 5, L. P. Alford, vice-president of the Ronald Press Co., will present a paper dealing with the progress that has been made in management and management methods during the last ten years. In this paper, Mr. Alford will deal with practically every phase of management, briefly reviewing the important advances that have been made. Two of the subjects with which he will deal are of broader significance than mere management details. One of these is "National Planning"; the other is "Service Motive in Industry."

Quoting from that part of the paper treating of national planning, Mr. Alford says: "Management is faced with the greatest challenge in its career, with the need and demand for national planning of industrial activities. The objective of national planning, in its economic aspect, is to attain and maintain in the United States a standard of living that is high, broadly distributed, and free from severe fluctuations; in its industrial aspect, it is to stabilize the operating performance of industrial enterprises; in its national aspect, it is to minimize the fluctuations of business and avert suffering such as the country is at present experiencing."

In dealing with the service motive in industry, Mr. Alford refers to the idealism of Taylor and Gantt. He also quotes Gerard Swope, president of the General Electric Co., as follows: "The reason for the existence of industrial organizations is not first and primarily for profit, but to furnish the community with something the community desires to have. If an organization furnishes something that the community wants, of good quality and at a fair price, it will always be rewarded for that service by an adequate profit."

The paper also emphasizes how the feeling of responsibility toward employes is manifesting itself in the management methods of many industrial concerns. The unemployment payment plan of the General Electric Co. is one of the outstanding examples of this, but there are many other similar plans in operation in numerous localities throughout the country. Management is awakened to its responsibility for the welfare of the community as a whole.

Fillet Sizes for Arc-Welded Construction

By E. W. P. SMITH, Consulting Engineer, Lincoln Electric Co., Cleveland, Ohio

Commenting on the article in September MACHINERY page 57, the writer is thoroughly in accord with the opening sentence: "The substitution of welding for riveting cannot be done properly in the ordinary welding shop without the guidance of experienced engineers." It was also stated that there is a tendency to make the fillet longer than is necessary. Inspection of jobs done by the welding process will show that the amount of weld is generally considerably in excess of that absolutely required, based on accurate strength figures—that is, the weld is stronger than the metal joined.

In the article referred to, a safety factor of 4 is used for certain figures, indicating a maximum stress in the neighborhood of 55,000 pounds per square inch. If the statements in reference to the length of the fillet weld are compared with the values used for the weld strength, it will be found that they are not quite consistent, because the rods that are available to the designer at the present time will deposit a weld metal that is superior to the plate. In other words, an ultimate strength of 70,000 pounds per square inch is now regularly obtained, and on this basis, the values that might be used for various working stresses will be somewhat higher than those given. The figures given in the article referred to are, as stated, accepted values, but they are not in line with the values obtained in modern practice.

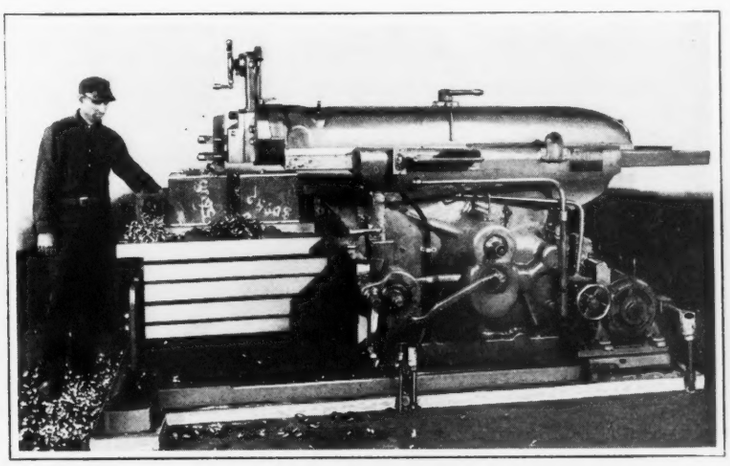
The reference to secondary stresses due to eccentric loading would lead one to believe that in welding we can neglect these factors. In a good many cases, it is necessary to consider these secondary stresses although, as stated in the previous article, a balanced arrangement of welding should be followed. There is another item that was not considered, and perhaps properly so, and that is the distribution of stress across the throat area. It is customary to assume that this distribution is uniform; but as a matter of fact, it is not uniform by any means, depending largely upon the shape of the particular joint involved.

It is also stated that the unit strength of a good small fillet is measurably greater than that of a larger one. The writer recalls tests made, he believes, at the University of Michigan, in which the larger bead showed a higher value for unit strength than the smaller one, due probably to the reason stated in the previous article—that is, a flaw in the small fillet has a proportionately greater weakening effect than in the larger fillet. However, this difference might have been due to the fact that a larger wire was used in making the larger fillet, so that a better metallurgical condition was obtained.

Shaper Effectively Used in Machining Die-Blocks

Heat-treated alloy-steel die-blocks with a Shore scleroscope hardness of 50 to 55, such as shown on the shaper table in the accompanying illustration, are not easy to machine. These blocks are 12 by 12 by 16 inches in size. In machining them with the equipment illustrated, 237.5 cubic inches of stock was removed in seventeen hours, showing a saving of seven hours over the time previously required.

This work was performed at the plant of the Pittsburgh Forging Co., Coraopolis, Pa., on a shaper built by the Ohio Machine Tool Co., Kenton, Ohio. The size of the shank planed across the 12-inch width of the blocks was 6 1/2 inches at the top and 2 1/32 inches deep, with a 7-degree angle. The accuracy was held to within 0.005 inch. The machining of the blocks also include planing the surface and matching the edges of the die-block, removing 1/4 inch of material from the surface and squaring the sides.



Machining Tough Heat-treated Alloy Steel Die-blocks on an Ohio Shaper

* * *

For drilling carbon electrodes, the drill must be extremely hard in order to resist severe abrasive action. Drills having tungsten-carbide inserts have been found to be very satisfactory for this purpose.

Turning Time for Shafts of Various Diameters and Lengths

By C. F. SCRIBNER

In establishing an incentive payment system in a large jobbing shop, it was found desirable to provide a convenient means of setting standard times for turning shafts varying considerably in diameter and length. The chart here illustrated was devised for this purpose. It gives the turning time per foot of shaft length, in minutes.

The turning time is determined by merely laying a straightedge from the graduation on the extreme left-hand scale that corresponds with the diameter of the shaft to the graduation on the extreme right-hand scale that corresponds with the number of feet per minute at which the operation is to be performed, and then laying a second straightedge from the intersection of the first with the "pivot point line" to the graduation of the desired feed per revolution on the fourth line from the left. The turning time per foot of shaft length is then read off at the point of intersection of the second straightedge with the middle scale of the chart. It is the practice to add 30 per cent to the actual turning time given by the chart for the preparation and handling of the work and for incentive, in order to obtain the "allowed time" for the operation.

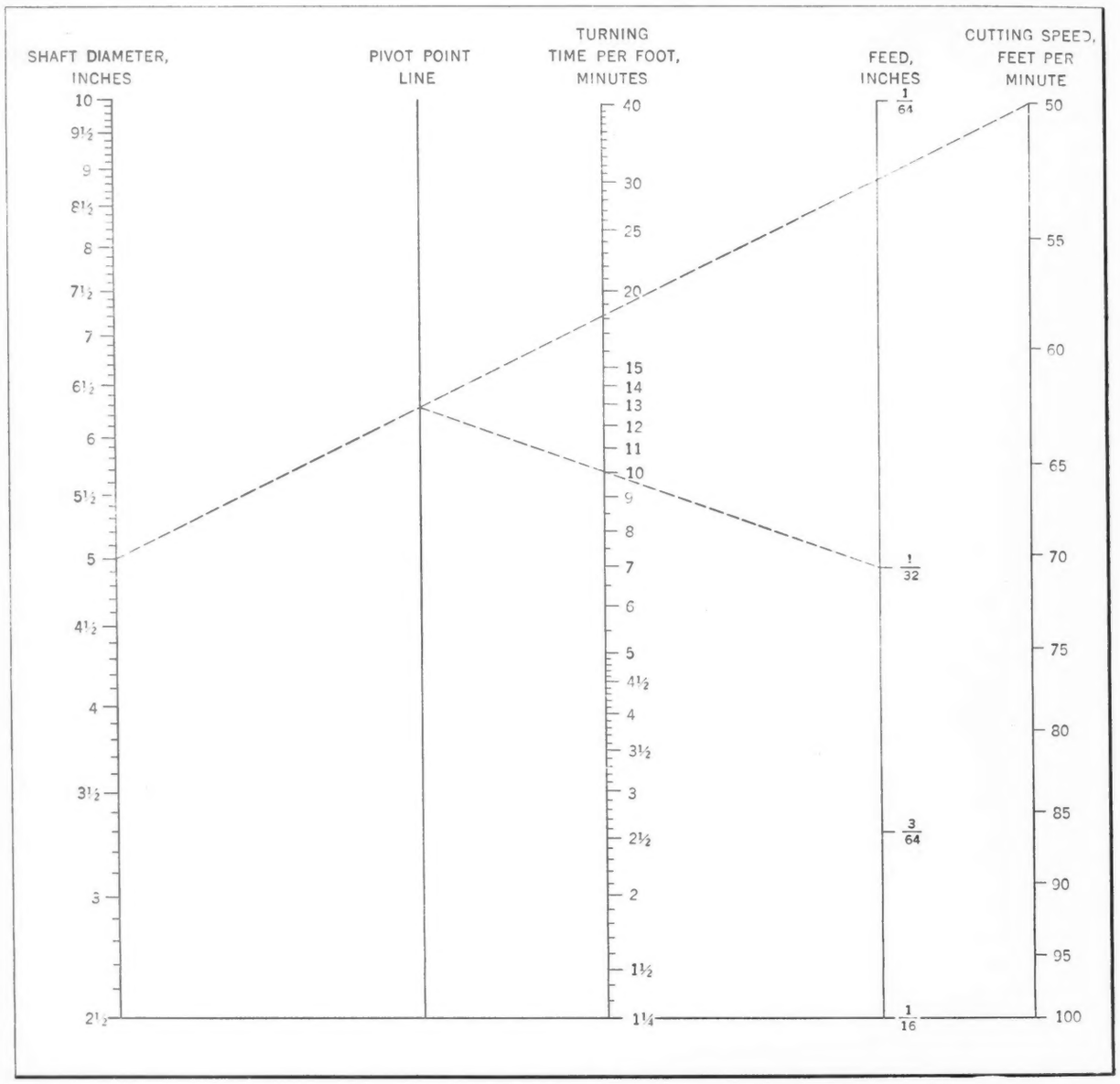


Chart Giving the Time Required for Turning Shafts of Various Diameters and Lengths

As an example, assume that it is desired to set the rate for turning four shafts, 5 inches in diameter by 35 feet in length, at a cutting speed of 50 feet per minute, with a feed of 1/16 inch per revolution for roughing and 1/32 inch per revolution for finishing. Assume, also, that the set-up time of the machine is 7.5 minutes per shaft.

By following the instructions given for using the chart, it will be found that the time for the roughing cut will be 5 minutes per foot, and for the finishing cut, 10 minutes per foot. Then the total time is determined as follows:

Roughing cut at 5 minutes per foot for 35 feet	175 minutes
Finishing cut at 10 minutes per foot for 35 feet	350 minutes
Thirty per cent of time for roughing and finishing cuts (allowed for preparation, handling, and incentive	157.5 minutes
Machine set-up time per shaft	7.5 minutes
Allowed time per shaft	690 minutes or 11.5 hours

Various cutting speeds for the different steels were also recommended as follows:

0.30 to 0.40 per cent carbon steel,	100 feet per minute
0.40 to 0.50 per cent carbon steel,	90 feet per minute
0.50 to 0.60 per cent carbon steel,	80 feet per minute
0.60 to 0.70 per cent carbon steel,	70 feet per minute
0.70 to 0.80 per cent carbon steel,	60 feet per minute
0.80 to 0.90 per cent carbon steel,	50 feet per minute

* * *

Using a Power Press to Operate a Bench Press

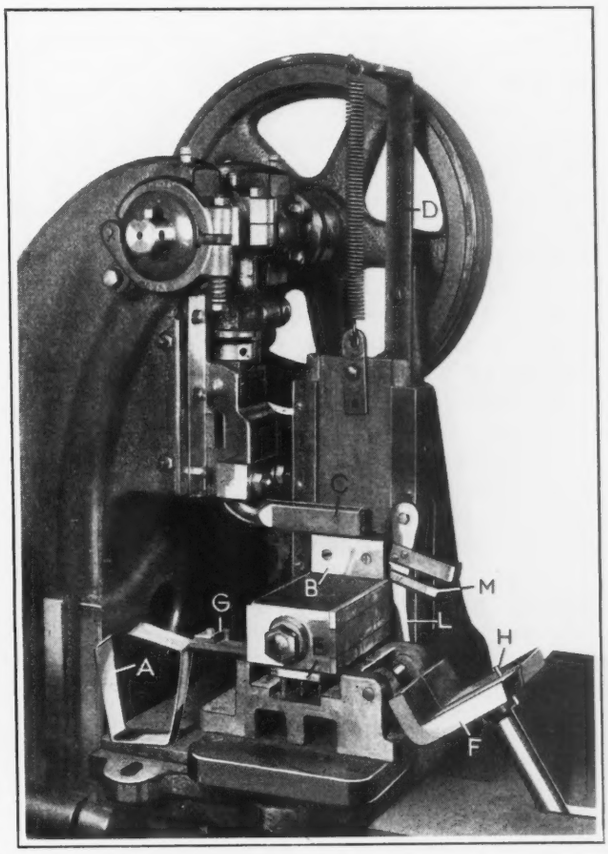
By S. A. McDONALD

The rectangular box body *A* shown in the accompanying illustration was originally formed in the corner-bending bench press at the right, which was operated by means of a foot-treadle. Foot operation of the press was satisfactory when small lots were required, but as the demand for the boxes increased, it became necessary to keep the bench press in continuous operation, and this was too tiring for the operator. Hence, the treadle was removed and the press set up on a horn press, as shown.

A pad *B* was secured to the slide of the bench press, and an L-shaped bar *C* was mounted in the ram of the horn press, so that it rested on pad *B*. An angle-bracket *D* was added to the frame of the press to provide a mounting for the helical spring which was attached to the press slide. The tension of the spring was sufficient to bring the press slide to the top of its stroke. With this arrangement, the slide of the box-forming press could be operated by the power press.

The lower part of the bending press consists primarily of a bolster with a spring-actuated pressure-pad *E* and a hand-operated hinged wing *F*. The upper member of the bending press has a forming block the size of the inside of the box to be formed. This forming block is bolted to the slide of the bench press. The blank to be bent is laid across the bolster and under the forming block, so that one end is located in the gage-block *G* to the left of the forming block. The opposite end of the blank is located against the disappearing pin *H* in the hinged wing. When the horn press is tripped, the L-shaped bar *C* presses down on the pad *B*, carrying the slide and forming block, with the blank, into the bolster. This action forms two of the corners of the box body.

When the bottom of the stroke is reached, a latch *L* on the side of the bench press snaps over the pad



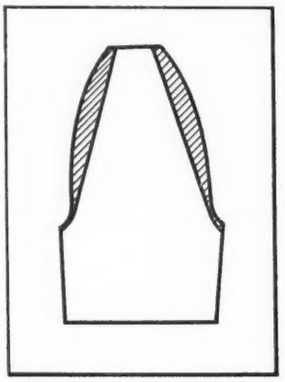
Foot-actuated Bench Press Mounted on a Horn-type Press for Power Operation

on the slide, preventing it from going up with the bar *C* as the ram ascends. The operator then swings the hinged wing *F* over the block, thus forming the third corner of the box. A trip pin (not visible in the illustration) on the back of the hinged wing engages the catch *M* on latch *L* when the wing is swung open, withdrawing the latch so that the slide returns to the top of its stroke, where the formed box body can be slid off the forming block. The formed body is then ready to go to a side-seaming machine.

The arrangement described so lightened the work that production was increased about 40 per cent. Also, it was found that the work could be performed by a girl, whereas a man was required to operate the foot-actuated press.

Localized Hardening Process

A localized surface hardening process to increase the wear resistance of steels has recently been developed and made commercially available by the Mackintosh-Hemphill Co., Pittsburgh, Pa. This process, known as the "Wearprooft," is applicable to many types of steel. It can be applied to gears, pinions, coupling boxes, spindles, and similar products subject to extreme wear. The process was developed primarily for treating Mackintosh-Hemphill's special alloy cast steel "MacHempIte," and it is in this application that the maximum degree of hardness and toughness is obtained.



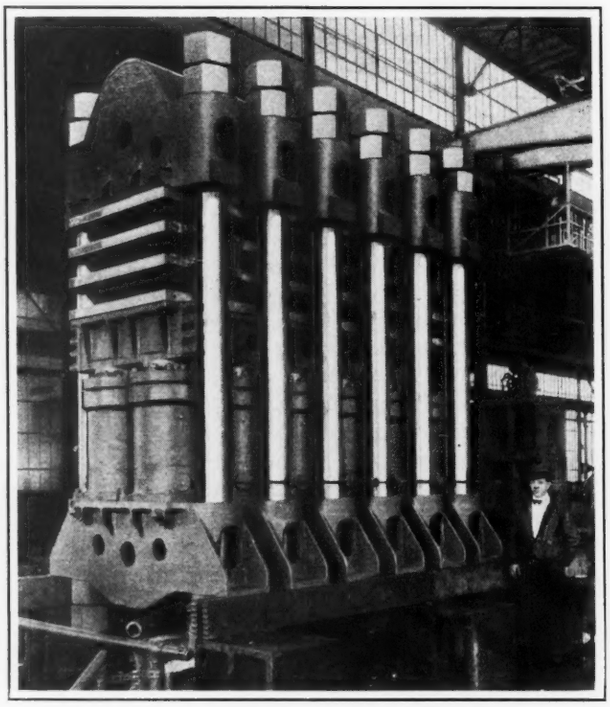
Cross-sectioned Areas of Gear Tooth Indicate Zones Hardened by "Wearprooft" Process

It is stated that this process introduces no stresses and that none are present after the treatment. Therefore, no subsequent dressing of the work is required. The penetration is held under accurate control, and is not permitted to extend deep enough to affect the strength and toughness of the base material. The hardness obtained ranges from 60 to 90 scleroscope. Either cast or machined surfaces can be treated.

The cross-section areas in the accompanying illustration of a gear tooth profile indicate the "Wearprooft" zones. These zones are hardened to from 70 to 80 scleroscope, while the core remains unaffected, retaining its original strength and toughness.

* * *

A new American recommended practice for foundry patterns of wood has been approved by the American Standards Association. The standard was submitted to this Association by the American Foundrymen's Association, working in conjunction with the American Society of Mechanical Engineers. The recommended practice specifies standard color markings for the location of cores, the surfaces to be machined, and the portions to be filled where stop-off construction is used.



A pressure of 10,000 tons—twenty million pounds—is applied by this huge steam platen press. It has twelve 18-inch rams. Under actual working loads, the maximum deflection of the platens is said to be not more than 0.004 inch. The Lake Erie Engineering Corporation, Buffalo, N. Y., was the builder of this press.

The Cheerful Side

Open-hearth and Bessemer-steel ingot production amounted to over a million tons in October, after having been below this level for four consecutive months. The daily average output reached over 40,000 tons, after being under this level for the same four months.

The machine tool industry reports more inquiries, a livelier interest in new equipment, and a few more actual orders. In domestic sales, October will show more encouraging results than September; that month, in turn, was a little ahead of August, July being the low month. This three months' continuous improvement, even though the upward trend is slight in encouraging. There is reason to believe that the improvement continued throughout November, although statistics are not yet available, because many of the inquiries on hand at the end of October were for machines intended for making new products.

Approximately 2500 men have been put to work in connection with the manufacture, sale, and installation of the new General Electric oil furnace and other air conditioning products. About 1500 men have been employed by dealers in connection with the new operation, despite the fact that the oil furnace is not yet being given national distribution. In addition, a large number of men have been reemployed in connection with the engineering, production, and manufacture of the oil furnace and air conditioner at Schenectady, Pittsfield, Mass., West Lynn, Mass., and Fort Wayne, Ind. An order was recently received, increasing by 50 per cent the furnace production till the first of the year.

The Superior Charcoal Iron Co., Grand Rapids, Mich., advises that shipments of charcoal iron and pig iron for the month of October were larger than during any preceding month this year, and the indications are that November shipments will show a further improvement.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies Can be Obtained by Writing Directly to the Manufacturer.

CONVEYING AND TRANSMITTING MACHINERY. Charles Bond Co., 617 Arch St., Philadelphia, Pa. Circular illustrating and describing Bond flexible insulated couplings. Leaflet entitled "15 Years of Service Without the Replacement of a Single Part," citing the record of a Bond flexible insulated coupling in an actual installation. The leaflet also contains a list of Bond products, including stock gears and sprockets, flexible couplings, revolving display tables, and truck casters.

ZINC PRODUCTS. New Jersey Zinc Co., 160 Front St., New York City. Circular containing data on Horse Head zinc for die-castings. The booklet contains considerable technical information on the properties of this material, the effect of aging treatments on the tensile strength, methods of stabilizing, and soldering and welding. It also contains a large number of illustrations showing die-castings made from this material for use in various industries.

COG-BELT DRIVES. Dayton Rubber Mfg. Co., Dayton, Ohio. Catalogue 105, on Dayton Cog-Belt drives. This is a condensed edition of the general catalogue on this subject, but contains all the data previously published. Information is given on the selection of the proper standard drive for various conditions, as well as simplified data for the calculation of special drives. Complete prices and dimensions are included.

WELDING MACHINES. Harnischfeger Corporation, 4400 W. National Ave., Milwaukee, Wis. Bulletin HW-2 entitled "Weld It Well!," describing the P & H "Hansen" line of arc-welding machines. A double-page spread shows clearly the construction and points of distinction of these machines, and another double-page spread shows their application on different classes of work.

MOTOR PULLEYS. Reeves Pulley Co., Columbus, Ind. Catalogue V-200, describing the design, operation, and uses of the Reeves Vari-Speed motor pulley, a variable-speed control unit directly applied to the motor shaft. The catalogue contains illustrations of typical applications, as well as engineering information that should be of value to machine designers and manufacturers.

MAGNESIUM ALLOYS. Dow Chemical Co., Midland, Mich. Circular illustrating various applications of Dowmetal, a magnesium alloy, which is available in the form of sand-castings, die-castings, forgings, extruded shapes, and sheets. Circular entitled "From the Shop Man's Viewpoint," showing examples of the machining, welding, and riveting of Dowmetal.

METAL CLEANING. Dow Chemical Co., Midland, Mich. Development Bulletin No. 18 entitled "Improved Methods of Industrial Metal Degreasing," consisting of a complete treatise on the subject of cleaning metal parts from oil and grease. The bulletin gives specific information about metal-cleaning solvents.

MOTORIZED SPEED REDUCERS. Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa. Catalogue containing tabulated dimensions of the various sizes of Philadelphia horizontal and vertical "Moto-ReduceRs." The catalogue also contains tables of horsepower ratings and speed reductions.

BRONZE WELDING ROD. Linde Air Products Co., 205 E. 42nd St., New York City. Booklet describing the physical and welding characteristics of Oxweld No. 25M bronze patented welding rod. Many important applications in joining metals and building up wearing surfaces are described.

STEEL SHEETS. Youngstown Sheet & Tube Co., Youngstown, Ohio. Bulletin containing a list of the products of the company, which includes raw and semi-finished material; tubular products; steel sheets; tin plate; tin-mill black plate; merchant bars and structural steel; wire products, etc.

ARC-WELDING MACHINES. Imperial Electric Co., Akron, Ohio. (Distributor, Bryant Machinery & Engineering Co., Chicago, Ill.) Bulletin S-584, illustrating and describing Imperial arc welders, which are made in portable and stationary types, and in sizes from 100 to 800 amperes.

BOLTS, NUTS, AND SCREWS. Clark Bros. Bolt Co., Milldale, Conn. Handbook of bolts, nuts, and screws, conveniently arranged and indexed. Data regarding heads, threads, weights, etc., are given, and there are several pages of illustrations showing special and odd-shaped bolts.

TESTING SIEVES. Newark Wire Cloth Co., 351-365 Verona Ave., Newark, N. J. Folder containing data on Newark testing sieves, which are made in accordance with U. S. and A. S. T. M. standards. The folder also gives information on the "End-Shak" testing-sieve shaker.

WELDING MACHINES. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet 20522-A, describing the application, distinctive features, and operation of the "Flex-Arc" alternating-current welder designed for the economical arc welding of thin-gage material.

HEAT-TREATING EQUIPMENT. W. S. Rockwell Co., 50 Church St., New York City. Bulletin 335, describing the advantages and application of the Rockwell roller-hearth electric and fuel furnaces for the continuous heat-treatment of metals.

METAL-CUTTING MACHINES. Racine Tool & Machine Co., Racine, Wis. Folder illustrating and describing Racine high-speed draw-cut metal-cutting machines, which are manufactured in sizes with capacities of from 4 to 15 inches.

BORING MACHINES. Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. Catalogue 3132, on Ex-Cell-O precision boring machines, which are made in two models—a single-end machine designed for light production requiring precision work, and a double-end machine designed for high-production precision work.

PACKING MATERIALS. Felt Products Mfg. Co., 1508 Carroll Ave., Chicago, Ill. Handbook on industrial packing materials. This book contains not only descriptions and lists of uses for which each material is suited, but also actual samples of thirty-six different materials.

ALUMINUM-COATING PROCESS. Aluminum Colors, Inc., 401 W. Michigan St., Indianapolis, Ind. Circular descriptive of the Alumilite Process, an electrolytic method of applying a protective and decorative coating to aluminum and its alloys.

RUST PREVENTIVE. American Chemical Paint Co., Ambler, Pa. Bulletin 20, treating of the cause and prevention of rust, as well as the advantages of A. C. P. elastic primer as a rust-preventive. Complete directions for use are included.

LUBRICATING EQUIPMENT. Lunkenheimer Co., Cincinnati, Ohio. Catalogue describing the construction, operation, and application of Lunkenheimer bottle oilers, especially adapted for lubricating bearings that are hard to reach.

DIAMOND BORING MACHINES. City Machine & Tool Works, East Third and June Sts., Dayton, Ohio. Circular announcing the new Cimatool diamond boring machines, which are made in three types to meet varying requirements.

PORTABLE MIXING MACHINES. Patterson Foundry & Machine Co., East Liverpool, Ohio. Circular descriptive of a portable mixer known as the "Typhoon" for mixing paint, oil, chemicals, dye, lacquer, etc.

CLUTCHES. Engineer's Specialty Co., 549 W. Randolph St., Chicago, Ill. Catalogue illustrating and describing the features of the Columbia one-way free-wheeling clutch and its various applications.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Loose-leaf circular No. 201 FE, illustrating the use of double-row angular-contact ball bearings in sheave mountings.

KNIFE- AND SAW-GRINDING MACHINERY. Samuel C. Rogers & Co., 191 Dutton Ave., Buffalo, N. Y. New price list covering the Rogers line of knife- and saw-grinding machinery.

PUMPS. Baldwin-Southwark Corporation, Philadelphia, Pa. Bulletin 36, illustrating and describing high-pressure hydraulic pumps for a wide range of applications.

LUBRICANTS. Acheson Oildag Co., Port Huron, Mich. Technical bulletin describing the use of colloidal graphite as a high-temperature lubricant.

SAWING VISE. Borden Co., Warren, Ohio. Form 432, illustrating and describing the Beaver square-end sawing vise for thin-walled copper or brass tubing up to 2 inches in diameter.

RUBBER BELTING. B. F. Goodrich Co., Akron, Ohio. Booklet entitled "Lubricated with Rubber," dealing with Highflex belting.

LIGHTING EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Catalogue 219-A, covering industrial lighting equipment.

A Workable Plan for Putting Men Back to Work

A constructive policy, aimed at putting men back to work at the earliest possible moment, has been announced by the Warner & Swasey Co., Cleveland, Ohio, in "A Statement of Policy" directed to the managements of industrial plants. The company makes the following announcement:

"*To get men back to work*—that is the paramount problem today with your company and with ours.

"The Robertson Rehabilitation Plan provides a method, but industry must provide the means.

"We build turret lathes. We have a substantial number of these finished and in stock. Nevertheless, for each turret lathe purchased from us we will put men to work immediately building a new one of equivalent value in order *to increase employment*.

"By this process you provide work not only for some of our employes, but for those of shops and mills whose products we use. Recovery demands cooperation in industry as never before.

"If you are really *interested in putting men to work*, here is the way to accomplish it."

The same idea is expressed in a letter by the company addressed to one of its customers, as follows:

"If you will order from us now the turret lathes of modern type which you need or must eventually purchase for replacement, we will put in process immediately, turret lathes of equivalent value for addition to our inventory.

"This will accomplish two purposes: It will give you the benefit of some proven reductions in your costs; it will immediately provide work for men in our plant, and indirectly for men in the shops and mills of our suppliers."

If all manufacturers financially able to follow this policy would carry out this plan during the immediate future, it would make it possible to re-employ hundreds and thousands of men who otherwise would remain idle until most of the backlog of products in stock has been taken up by immediate demand.

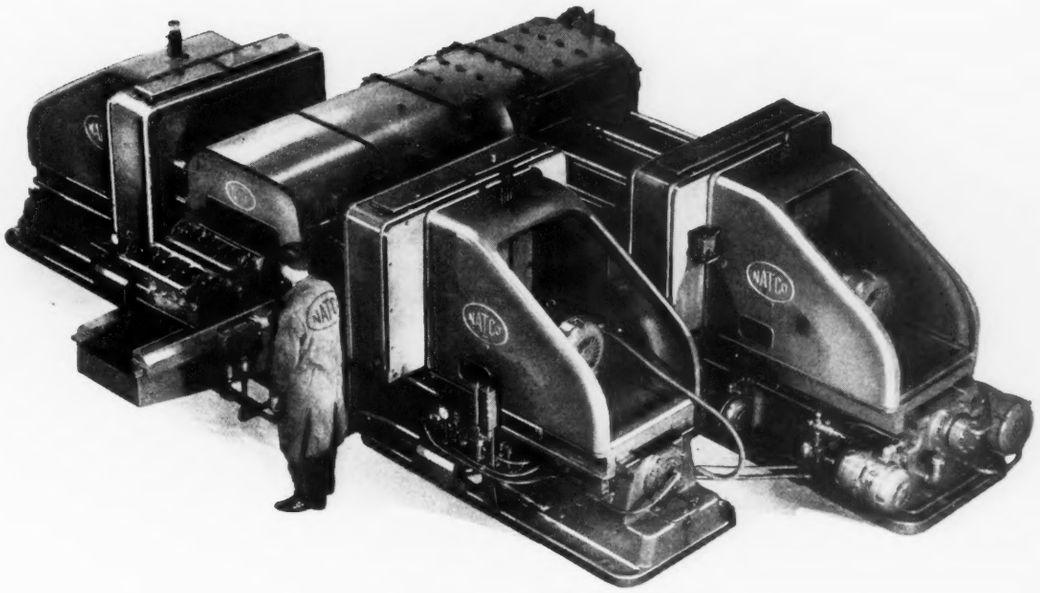
Exposition of Mechanical Engineering

The tenth National Exposition of Power and Mechanical Engineering, to be held at the Grand Central Palace, New York, December 5 to 10 coincident with the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers, will be open daily during the week, from 12 noon until 10:30 P.M. The products of three hundred manufacturers of power and mechanical equipment will be shown. Among the exhibits will be valves and fittings of alloy steel developed to meet the trend toward higher steam pressures and temperatures. The progress in welding within the last few years will be evidenced by the display of welded fittings and fusion-welded boiler drums.

As it is two years since the last exposition, it is expected that this year's display will introduce many new devices and methods that will be shown for the first time, thus insuring an exhibit of unusual engineering as well as educational interest.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market



Natco Hydraulically Fed Machines for Automobile Plants

Two machines recently built by the National Automatic Tool Co., Richmond, Ind., to help reduce production costs in the automobile field to even lower levels than in the past are here illustrated. Both machines are equipped with heads that are fed to and from the work hydraulically. The machine shown in the heading illustration bores the camshaft and crankshaft bearing holes in medium-sized cylinder blocks and drills and counterbores the Welch plug holes at the same time. Seventy-five cylinder blocks are machined an hour with this equipment.

The two front heads are mounted on Natco 6-inch hydraulic units and have 24 inches of travel, while the rear head is mounted on an 8-inch hydraulic unit and is arranged with 42 inches of travel. Roller bearings are supplied for the spindles of both heads, as well as nose adjustments.

The three hydraulic units are bolted to a large welded-steel pedestal on which a four-position automatic conveyor type of fixture is mounted. Two cylinder blocks are held in each position of the fixture. The fixture is operated by hydraulic pressure and is interlocked electrically to the heads, so as to insure that all cylinder blocks will be in their correct positions before the heads begin their operations.

While the heads are completing their cycles, the conveyor returns to the loading position and the operator loads two cylinder blocks ready for the next cycle. Complete control of the machine is obtained through one push-button station.

The machine shown in Fig. 1 has four heads which perform a total of eighteen different operations on the distributor-shaft hole in both sides of cylinder blocks. These operations consist of drilling, counterboring, facing, chamfering, countersinking, and tapping. The production in this case also averages seventy-five cylinder blocks an hour.

Two large units perform all the operations, with the exception of tapping. In addition to the hydraulic feeds provided for these units, they are both equipped with a time-delay reverse and a positive stop. The tapping heads are driven by a single reversing motor. Each tapping spindle is equipped with an individual lead-screw to insure correct thread leads.

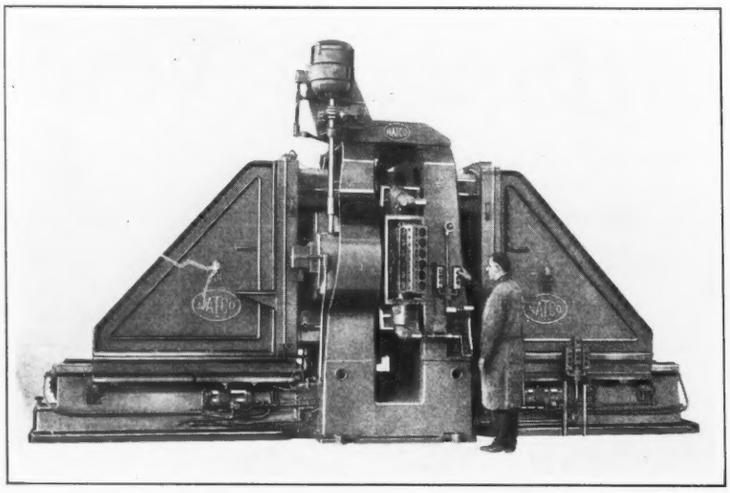


Fig. 1. Natco Two-way Machine which Performs Eighteen Operations on the Distributor-shaft Holes of Cylinder Blocks

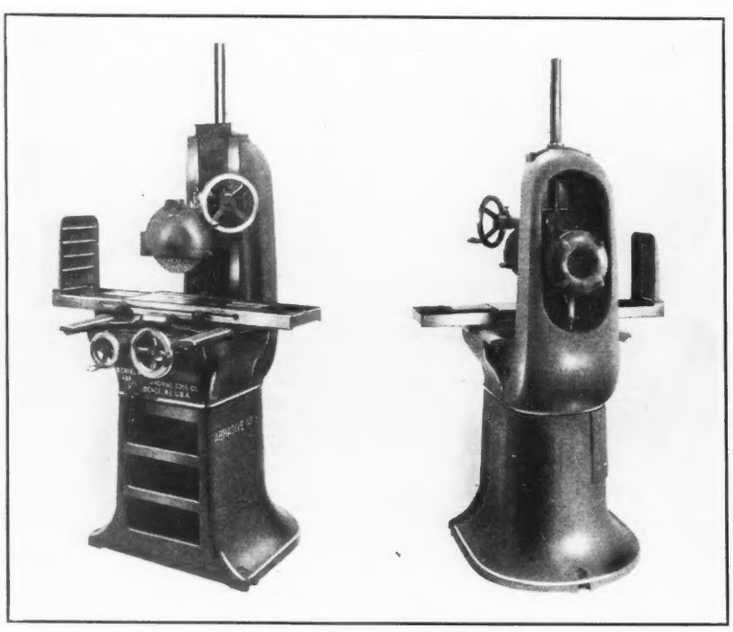
A five-position trunnion type of fixture indexes automatically to bring the cylinder blocks into line with the various tools. One cylinder block is held in each position of the fixture. The machine is semi-automatic in operation. Interlocking devices guard against indexing of the fixture before the heads are in their correct positions and also prevent the heads from starting before the fixture is properly positioned.

Abrasive Medium-Capacity Surface Grinder

A surface grinder having sufficient capacity to enable toolmakers to finish fairly wide pieces has been added to the line of grinding equipment built by the Abrasive Machine Tool Co., East Providence, R. I. The table work surface of this No. 1 1/2 machine measures 15 by 10 inches. The longitudinal movement of the table is 15 inches and the transverse movement 10 inches, while the vertical adjustment of the grinding wheel head is 12 inches. The machine is suitable for fine flat or form grinding, and for the grinding of gages.

As the result of an extensive investigation, the concern decided that a large percentage of the tool work performed on surface grinders is done by hand, because the job usually consists of one piece only and the operator does not take time to adjust automatic feeds. For this reason, all feeds on this machine are hand-operated. The elevating handwheel is equipped with a vernier reading to 0.00025 inch. The sides of the table are ground square with the spindle for use in setting up work.

The grinding wheel is driven by a one-horsepower motor mounted directly on the spindle. Except for the spindle, which has a normal speed of 1750 revolutions per minute, there are no fast moving parts, and consequently, there is practically no vibration. A 10-inch grinding wheel, 1/2 inch thick, is standard. The machine can be connected to a central exhaust system or a motorized exhaust attachment can be furnished.



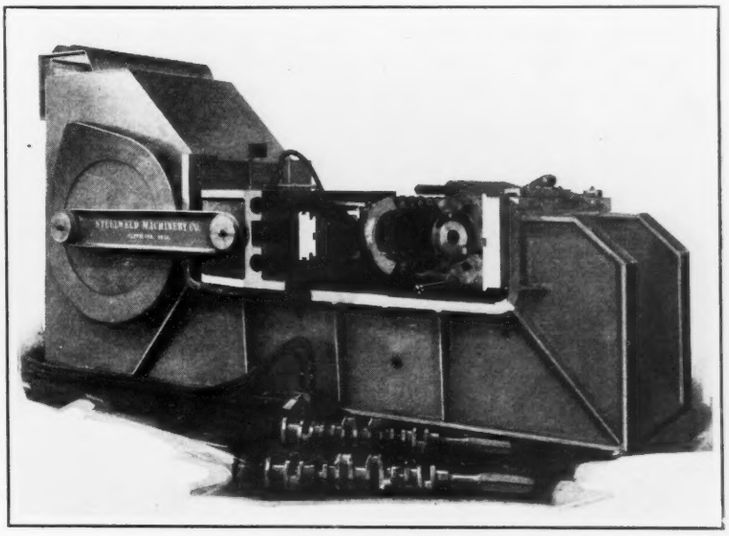
Surface Grinder of Medium Capacity Built by the Abrasive Machine Tool Co.

Oliver Horizontal Belt-Sander

A self-contained horizontal sanding and polishing machine of the belt type which is intended for certain types of metal grinding and polishing on aluminum and brass castings, etc., as well as for operations on wood, is the latest development of the Oliver Machinery Co., Grand Rapids, Mich. Flat work up to 46 inches long by 26 inches wide can be supported directly on the table and sanded or polished at one setting. The table is adjustable for obtaining heights up to 9 inches between the table and the bottom of the top belt. Belts up to 5 inches wide can be used.

Steelweld Crankshaft Twisting Machine

A machine for offsetting the throws of automobile crankshafts that are forged with the crankpins and main bearings in one line has been developed by the Steelweld Machinery Co., E. 70th St. and Machinery Ave., Cleveland, Ohio. This machine can handle any size crankshaft, from those for small four-cylinder engines up to crankshafts 72 inches long and with as large bearing diameters as may be desired. It is customarily arranged to make four twists at one time, but eight or more twists can be made simultaneously. The twisting is done either on the main bearings or on the crankpins.



Machine of Welded-steel Construction for Offsetting the Throws of Automobile Crankshafts

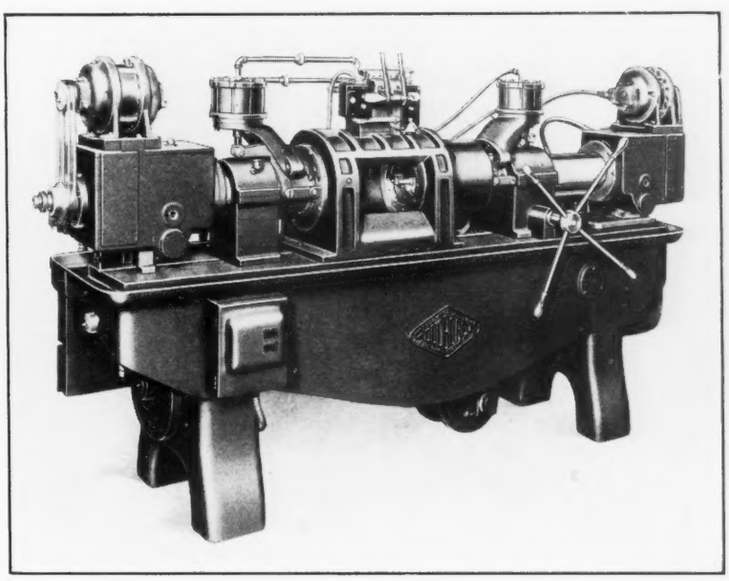
The machine offsets the throws to the desired angles by twisting the crankshaft at the forging heat as it comes from the forging hammer, without reheating. The crankshaft is entirely enclosed in the die that does the twisting. The floor-to-floor time per crankshaft is less than one minute. The frame of this machine is of welded construction.

Cimatool Duobore Diamond Boring Machine

Work can be simultaneously bored from opposite ends in a Duobore diamond boring machine recently added to the line built by the City Machine & Tool Works, E. Third and June Sts., Dayton, Ohio. The machine has been especially built for all kinds of transmission gears. When used on single-bearing gears, two gears are bored at one time.

In boring a cluster gear with a bearing at both ends, the operator slips one end of the gear into a Bolender gear chuck, and with a capstan wheel, advances another chuck of the same type to engage the opposite end. By opening a valve, pressure is then built up in two hydraulic cylinders for closing the chucks. When the valve lever is moved down, it exposes an electric starting button which the operator pushes to start rotating and feeding the spindles. An electric signal light shows when the spindles leave their idle positions.

After the boring has been completed, an electric trip automatically stops the spindle driving motors and applies electric brakes to the spindles. A third motor, which actuates the feed-cams, continues running until the spindles have been completely withdrawn from the work. When the machine is used for boring single-bearing gears, the right-hand chuck remains in its "return" position.

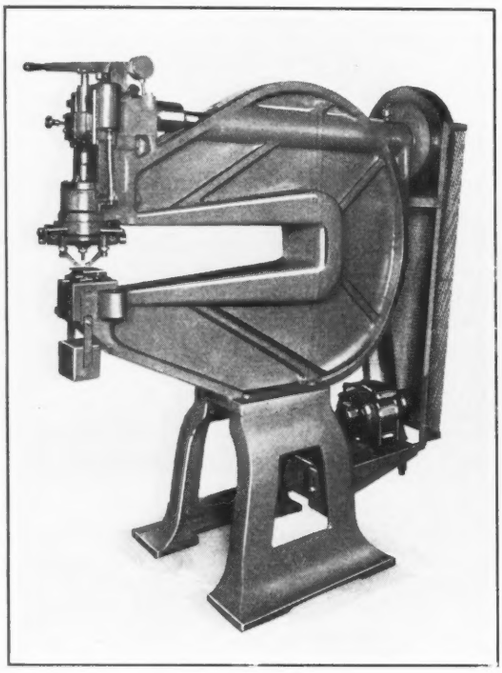


Duobore Diamond Boring Machine Designed Especially for Transmission Gears

Square D One-Horsepower Disk Switch

A disk type of switch with a capacity of 30 amperes or 1 horsepower at 125 volts, though only 5 3/8 inches high by 3 1/8

inches wide by 2 3/4 inches deep, has been developed by the Square D Co., Detroit, Mich. Instead of the conventional knife-blade construction, a small disk rotates between two spring copper blades. This feature permits the switch to be operated from the front of the cabinet. The terminals are conveniently located, so that the interior of the switch need not be removed for wiring. The switch has been designated "Catalogue No. 90211."



Machine that can be Quickly Converted from a Nibbling Machine into a Shear and Vice Versa

Gray Turret-Head Metal Cutter

In a turret-head metal cutter just brought out by the Gray Machine Co., Box 596, Philadelphia, Pa., the eccentric is detachable from the main drive shaft and the cross-head is so constructed that eccentrics of various throws from 5/8 down to 1/32 inch can be quickly inserted. This feature permits using a shearing attachment for intricate cuts in light stock. The machine can thus be converted from nibbling equipment into a high-speed shear or vice versa.

With the change of eccentrics, speeds can be altered from 550 to 1200 revolutions per minute. The machine has a 36-inch throat, and a capacity for cutting stock up to 3/8 inch thick. The revolving turret head permits cuts to be made in all directions in a sheet too large to be turned in the throat.

Gorton Profiling, Die-Cutting, and Engraving Machines

One of the latest additions to the line of profiling, die-cutting, engraving, and milling machines built by the George Gorton Machine Co., Racine, Wis., is the No. 3-K matrix machine shown in Fig. 1. This machine is primarily designed for producing letters and designs, sunk or in relief, on either flat or curved surfaces of steel stamps. It is also suitable for the production profiling of small parts held to close limits, and for machining small intricate dies, punches, cams, templets, and gages that must have a high degree of accuracy.

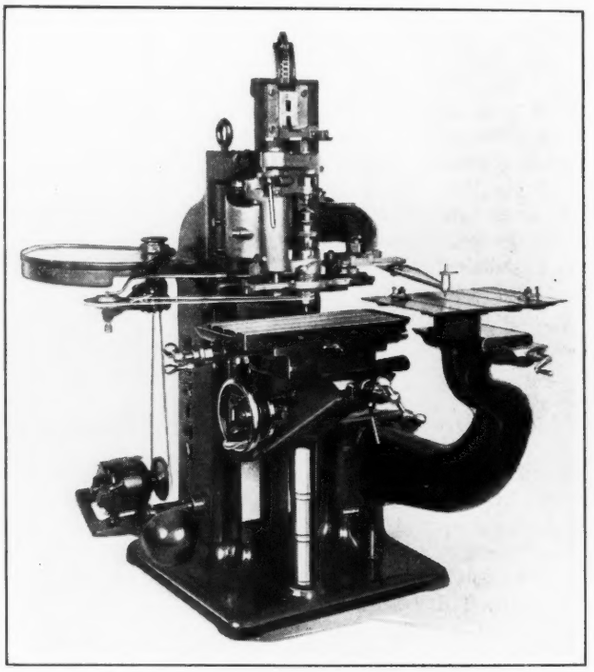


Fig. 1. Gorton Profiling and Die-cutting Machine Designed Especially for Producing Steel Stamps

The machine operates on the pantograph principle, using a large master or pattern for guiding the cutter. A quickly removable spindle permits the grinding of cutters while in place. There is an improved forming attachment which enables operations to be performed on curves of very small radius and on surfaces of steep angles. The longitudinal feed of the table is 12 inches and the cross-feed 8 3/4 inches.

Fig. 2 shows a roll-engraving machine, 16 feet long, which was recently built by the same company for cutting letters and designs on rubber, brass, copper, or steel printing and embossing rolls. Rolls from the smallest diameter and shortest length up to 30 inches in diameter by 12 1/2 feet long can be handled by the machine illustrated. A shorter base can be provided

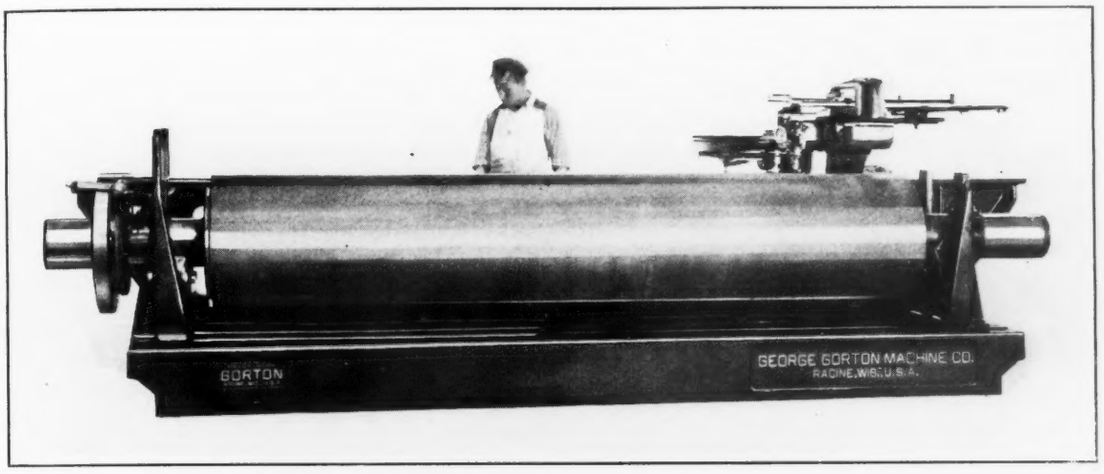


Fig. 2. Machine that Engraves Printing and Embossing Rolls up to 30 Inches in Diameter by 12 1/2 Feet Long

when the maximum length of rolls to be handled is 8 feet. An indexing fixture with a dial 24 inches in diameter is clamped on the journal of the roll to be engraved to insure accuracy.

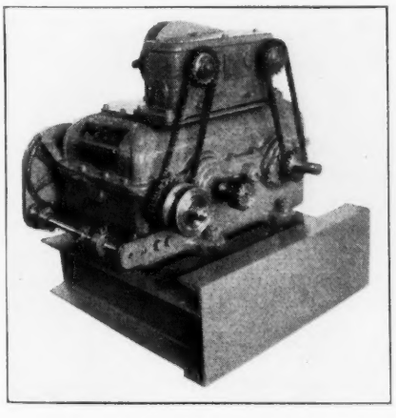
Link-Belt Variable-Speed Transmission

An automatic time-cycle control and an unusually close speed control are features of a variable-speed transmission recently developed by the Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill. In designing this unit, the problem was to obtain a stepless straight-line speed decrease of a machine shaft under a combination of variables. First, the starting speed was to be selective within given limits; second, the speed decrease was to be selective between 1 and 18 per cent; and third, the time was to be selective between one and twenty-four hours. Once a setting was made, an indefinite repetition of results was required.

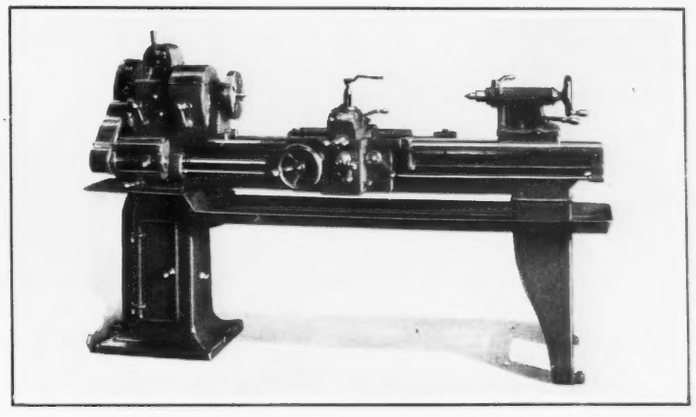
The unit illustrated is a Link-Belt P.I.V. gear unit with a special speed reduction unit mounted on top and connected by roller chain drives to the constant-speed shaft of the gear unit and its control screw. The special reduction unit has a maximum ratio of 1,380,000 to 1 and a minimum ratio of about 94,740 to 1. When the control screw is operating at minimum speed, the total reduction from the constant-speed shaft to the control screw is 1,840,000 to 1.

LeBlond "Super Regal" Engine Lathe

Simplicity of control and automatic lubrication are features of a "Super Regal" engine lathe which is being placed on the market by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, in 12- and 14-inch sizes. In addition to the gears that provide eight selective speed changes, the feed reverse and feed compound-



Variable-speed Transmission with Automatic Time-cycle Control



Le Blond Lathe with Simplified Control and Automatic Lubrication

ing gears are contained in the head, eliminating tumbler gears and swinging plates on the end of the bed. All controls are within easy reach of the operator. The moving parts of the apron run in oil, and the rack pinion and handwheel roll on ball bearings. A plunger pump in the apron reservoir lubricates the carriage and cross-slide ways, as well as the bearings of the cross-feed screw.

One safety interlocked trip-lever controls both carriage cross-slide movements. The motor is mounted on a hinged plate at the rear of the cabinet leg.

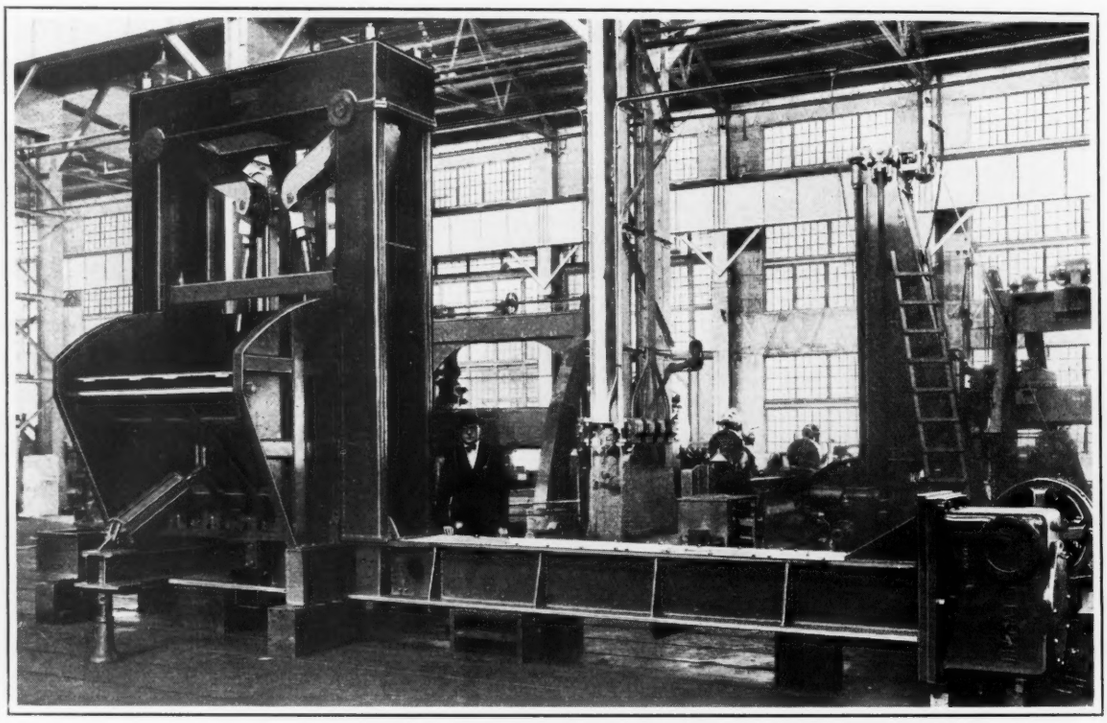
Wel-Don End-Mill Kit

The Weldon Tool Co., 1426 W. Third St., Cleveland, Ohio, has placed on the market a kit of end-mills designated No. 1. This kit is intended to prevent the loss and damage of end-mills in the tool-room. It contains a complete set of roughing and finishing cutters from 1/8 to 1/2 inch in diameter. A wrench and tool-holder are included.

The mills from 1/8 to 3/8 inch are of the double-end type, while the larger sizes are of the single-end type, so that they can be used in the same holder. When the box-lid is closed, each tool is clamped in a wooden chock, which prevents it from coming into contact with other tools or parts.

Baldwin-Southwark Baling Presses

Large machines for pressing into compact bales the scrap from power presses, shears, and similar equipment are built by the Baldwin-Southwark Corporation, Philadelphia, Pa. The illustration shows an all-welded steel machine that is mechanically and pneumatically operated. An air cylinder swings the front side of the hopper inward to start compressing the scrap into a bale and returns it to its original position at the end of the operation. In the second step of the operation, the scrap is pushed down from the top through the action of two toggles operated by a motor and screw at the rear of the machine. Then the scrap is compressed lengthwise as a nut is advanced by a screw in the long box-like extension at the right. This screw is driven by a separate motor and worm reduction gearing.



Baldwin-Southwark Baling Press of All-welded Steel Construction, Operated Mechanically and Pneumatically

The bale is formed lengthwise by compressing it against the end of the last previous bale, which remains in the machine until the new bale has been produced. The previous bale is held in an ejecting chute by air-controlled detents. At the proper time, the detents are released, the previous bale is ejected, and the newly formed bale is advanced to the detents.

When this machine is installed in a plant, the front edge of the hopper is on a level with the floor. It compresses bales to a

density of about 25 per cent. Baling machines with hydraulic cylinders for actuating all steps of the operation are also built by the concern. These machines usually compress bales to a density of 33 per cent, but greater densities can be attained.

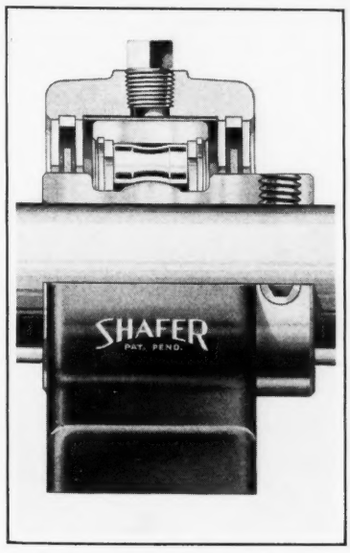
Rubber Belt Designed for Low-Tension Operation

The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., has produced a "Compensated" rubber belt, the pulley surface of which is especially treated to give it a high coefficient of friction. It is claimed that this belt develops unusually high horsepower, with reduced slip and creep. Trouble from ruptured outside plies is said to be eliminated. The belt will run on small sizes of pulleys.

Shafer Single-Row Radial Roller Bearings

Single-row self-aligning radial roller bearings with concave rollers operating between a straight outer race and a convex inner race have been brought out by the Shafer Bearing Corporation, 621 S. Kolmar Ave., Chicago, Ill. The self-aligning feature of the bearing compensates for misalignment due to inaccuracies in machining or to shaft deflection under load.

The illustration shows one of these new bearings in a pillow block. They are also obtainable separately, as well as in flange units, hanger boxes, and take-up units for shafts from 9/16 to 2 3/16 inches, inclusive.



Pillow Block with Roller Bearing Having Concave Rollers

Amthor Testing Device for Determining Tensile Strength

Amthor Tensile Strength Tester

The tensile strength of a wide variety of materials can be tested with the device here shown, which has just been designed by the Amthor Testing Instrument Co., Inc., 309 Johnson St., Brooklyn, N. Y. The dial is 8 1/2 inches in diameter and is graduated in fractions of either pounds or kilograms.

When the specimen breaks, the pointer remains at the calibration that indicates the tensile strength. The jaws and jaw-travel can be made to conform with standard test methods for wire, sheet metal, rubber, and other materials.

Starrett Inside Micrometer

Starrett Inside Micrometer Caliper for Small Dimensions

A No. 700 inside micrometer caliper, designed to measure holes, slots, or grooves too small for regular inside micrometers, has been added to the line of small tools manufactured by the L. S. Starrett Co., Athol, Mass. All dimensions between 0.200 and 1 inch can be measured in thousandths of an inch.

As the illustration shows, this micrometer combines the sliding jaws of a slide caliper and the easy reading thimble and sleeve arrangement of a micrometer caliper. One jaw is fixed, while the other is attached to the sleeve and opens or closes as the thimble is turned.

The caliper can be converted into a fixed gage by turning the lock-nut. A small knurled extension on the thimble spins easily between the thumb and finger for opening or closing the jaws.

Sandblasting Machine for Small and Medium-Sized Parts

A machine designed for automatically sandblasting small and medium-sized castings has been developed by Schucht-Mier-Robertson, Inc., 152 W. Wisconsin Ave., Milwaukee, Wis. In this machine, the work pieces are suspended from a number of arms that branch out from a

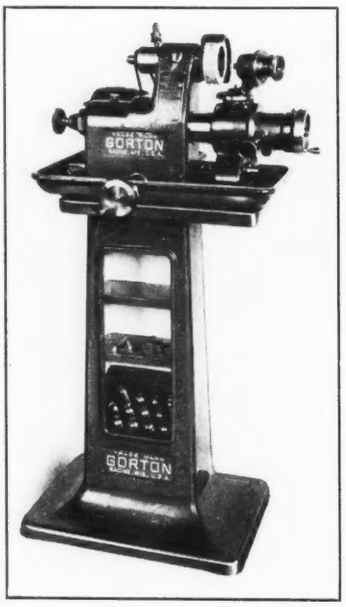
slowly rotating vertical shaft. In addition, the parts turn about their own axes. They travel slowly through a semicircular blasting chamber, the loading, sandblasting, and unloading being performed continuously.

Adjustable nozzles mounted along the walls of the blasting chamber insure a uniform sandblasting job. Various gates which are passed successively by the work prevent the escape of sand.

Louis Allis Motorized Speed Reducers

A line of motorized speed reducers designed to accommodate almost any type of motor has been placed on the market by the Louis Allis Co., Milwaukee, Wis. The motor and speed reducer are combined into one compact self-contained unit. Ratings from 3/4 to 75 horsepower are available, together with output speeds from 4 to 400 revolutions per minute.

The integral style shown in the illustration has the end-bell removed and the motor close-coupled to the gear casing. This style is most common when an open motor or an enclosed non-ventilated motor is employed. The reducers are also made in a flexible style in which the entire motor, without any change, is mounted on the gear casing. This style is furnished when installations require an explosion-proof, enclosed fan-cooled, splash-proof, or other protective type of motor.



Universal Grinder for Profiling, Engraving, and Similar Cutters

Grinder for Small Milling and Die-Sinking Cutters

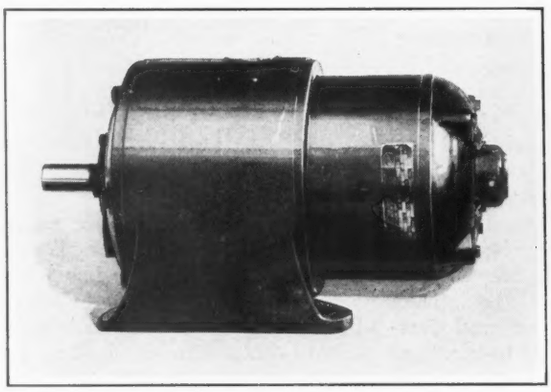
The George Gorton Machine Co., Racine, Wis., has recently brought out an improved grinder for small milling and die-sinking cutters, such as are used in the high-speed profiling, die-cutting, engraving, routing, and milling machines made by this concern. The universal tool-head of the machine accommodates many types of cutters, including fluted mills and single-lip, two-lip and three- or four-sided cutters. Straight-shank cutters from 1/10 to 5/8 inch in diameter can be handled, the machine being especially suited to grinding delicate points down to 0.015 inch in diameter and even smaller. Cutters with tungsten- and tantalum-carbide tips can be ground and lapped.

The universal tool-head can be swiveled to any angle. A dial at the rear provides for indexing the cutters. The machine is built in bench and pedestal types.

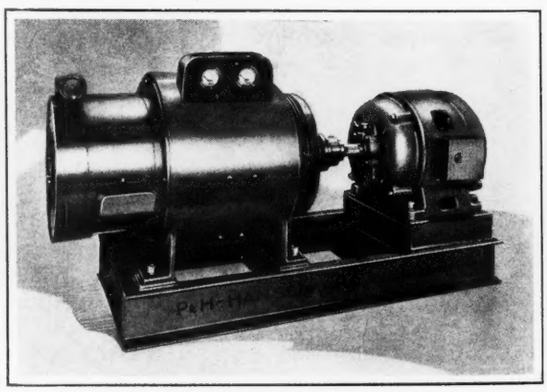
P & H Hansen Welders of Improved Design

Improvements have recently been made in the line of P. & H. Hansen arc welders built by the Harnischfeger Corporation, 4400 W. National Ave., Milwaukee, Wis. A new magnetic bridge and a unique short-circuit winding have extended the range and improved arc recovery and arc stability. A new dead-front control cabinet adds to the general appearance of the unit and simplifies the design. A voltmeter, ammeter, etc., are contained in a single compact cabinet.

Single-operator, motor-driven welders are produced in 100-, 200-, 300-, 400-, 600-, and 800-ampere sizes. Up to the 300-ampere size, the motor and generator are arranged as a single unit to form a compact two-bearing machine. The larger sizes are arranged as four-bearing units, the generator and motor being direct-coupled and mounted on a welded-steel base. These arc welders are made in stationary



Louis Allis Speed Reducer with the Motor Close-coupled to the Gear Casing



Arc Welder of an Improved Line Made by the Harnischfeger Corporation

and portable types for operation on either alternating or direct current.

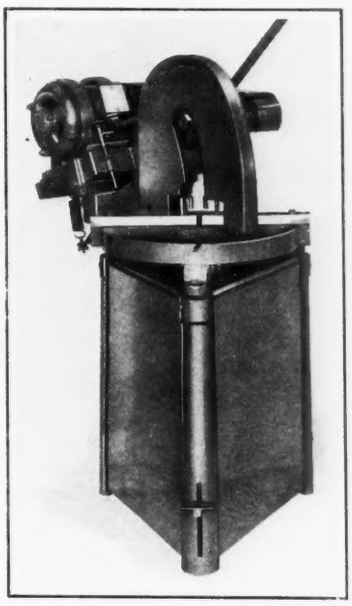
Flosol Cream Soldering Flux

A flux designed for use in soldering sheet steel when the prevention of rust is of vital importance has been developed by the American Chemical Paint Co., Ambler, Pa. This flux is a white creamy chemical known by the trade name of "Flosol Cream." It is brushed like paint on the metal to be soldered. The flux-covered surface can be tinned and soldered before or after the coating dries. From ten to fifteen minutes is required for drying.

This cream fluxes with most of the commonly used metals except aluminum and its alloys. It is available in twelve-pound cans and sixty-pound pails.

Swivel-Table Abrasive Cut-Off Machine

In the high-speed abrasive cut-off machine now being placed on the market by the Tannewitz Works, Grand Rapids, Mich., the motor and saw yoke are mounted on a circular table that can be swiveled from 45 degrees right to 45 degrees left. This construction makes it unnecessary to swing the stock around for cutting it at different angles, and thus saves floor space.



Abrasive Cut-off Saw with Swiveling Table

The machine is intended for cutting metal molding, tubing, and small bars. It is made in two sizes, the smaller for motors up to 7 1/2 horsepower, and the larger for motors up to 15 horsepower.

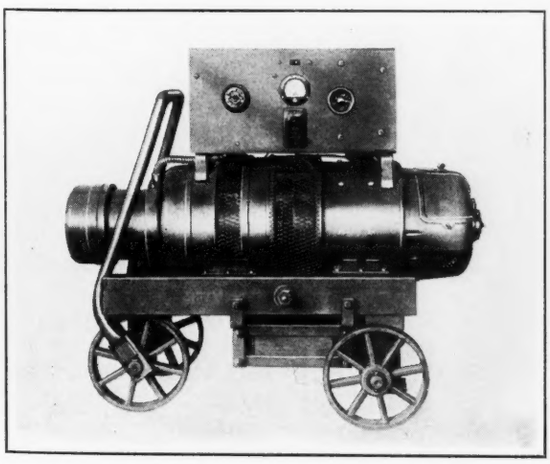
Imperial Arc Welders

A new line of arc welders is being introduced to the trade by the Imperial Electric Co., Akron, Ohio, in standard sizes ranging from 100 to 800 amperes (see accompanying illustration). Larger sizes and special welders can also be supplied. The new line is made in all the conventional types—with a motor, gasoline engine, or belt drive, and with track arrangements. Such metals as chrome-nickel, 18-8, and other non-ferrous alloys can be welded with the new line.

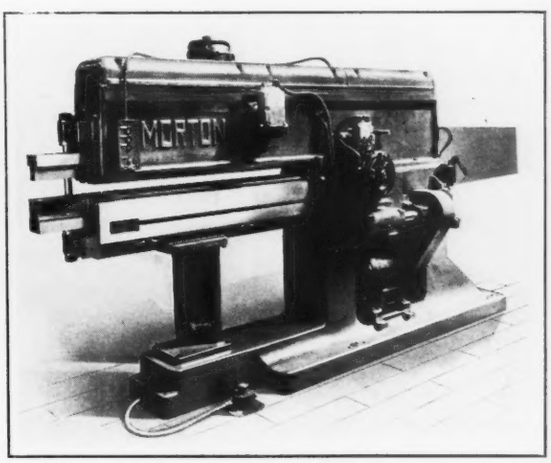
The important features of these welders include a dual control for close regulation of the welding heat, separate excitation for quick recovery, a reverse polarity switch for convenience in changing leads, and a rubber mounting which has been termed "cushioned energy." The Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill., is the exclusive national distributor for these welders.

Morton Draw-Cut Flash-Trimming Machine

Another high-duty draw-cut machine has been added to the line of the Morton Mfg. Co., Broadway and Hoyt St., Muskegon Heights, Mich., for trimming the flash or upset from butt-welded seams in strips, sheets, or plates. The machine illustrated has a stroke of 48 inches, but any length of stroke can be provided. Other flash-trimming machines built by the concern were described in July



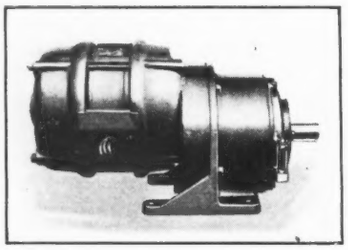
One of a New Line of Imperial Arc Welding Machines



Morton Electrically Controlled Flash-trimming Machine

and August MACHINERY, pages 858 and 953, respectively.

Complete electrical control through hand or foot push-buttons is a new feature of this machine. The use of air has been dispensed with for clamping the work while trimming. Removable liners are provided for the ram bearings to insure accuracy and long life. Slight variations in the thickness of the metal being trimmed are taken care of automatically. The distance between the clamping jaws and the cutters when the upper ram is raised is approximately 2 inches.



Geared Motor Made by the Ideal Electric & Mfg. Co.

Geared Motors

Gear reduction units built integral with a motor are now made by the Ideal Electric & Mfg. Co., Mansfield, Ohio, in all ratios from 2.09 to 1 up to 376 to 1. The output speeds range from 861 to 4.7 revolutions per minute with a motor of 1800 revolutions per minute. The high-speed gear is mounted directly on the motor shaft.

For ratios up to about 6 to 1, the reducer is of the single-stage helical gear type, while for higher ratios up to and including 24.5 to 1, a two-stage helical gear reducer is used. For ratios of 30 to 1 and higher, one stage of helical gears and one stage of heliocentric gears are provided.

These geared motors are available in all horsepower ratings from 3/4 to 20. Open or enclosed motors are furnished.

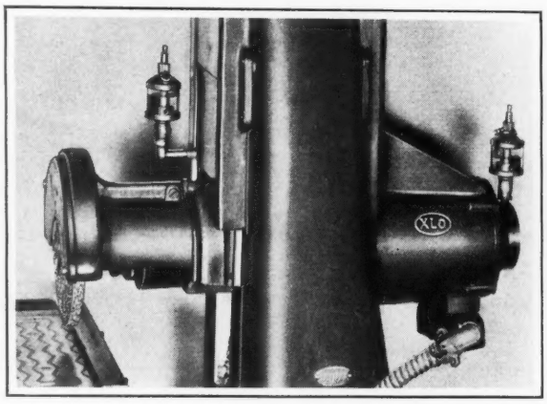
Dumore Wrench-Tooth Grinder

A small bench grinder for keeping pipe wrenches in good condition has been added to the products of the Dumore Co., 16th St. and Junction Ave., Racine, Wis. This grinder has a long wheel-arbor which provides sufficient clearance for the largest wrench jaws. The motor is of the universal type for operation on both alternating and direct current. It is rated at 1/8 horsepower and runs at 8000 revolutions per minute, thus providing for grinding wrench teeth quickly without removing the temper.

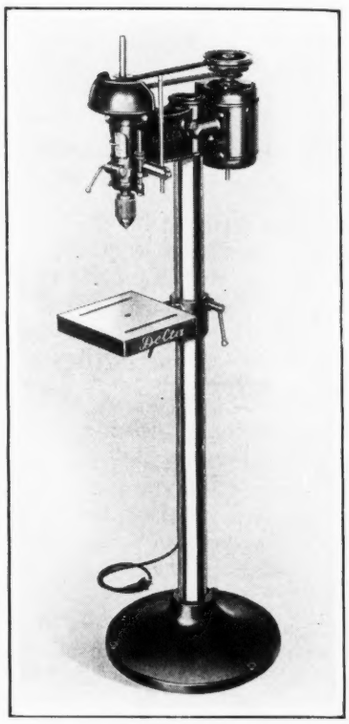
Motor-Driven Spindles for Surface Grinders

The Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., has brought out two direct motor-driven spindles for application to Brown & Sharpe No. 2 surface grinders. The illustration shows a heavy-duty spindle with a special bracket for supporting an inbuilt motor drive. The grinding spindle and motor are mounted on a common shaft and the motor field is pressed into the back of the bracket.

The second type of direct motor-driven spindle made by the company can be fitted into the regular Brown & Sharpe bracket by boring it to suit and drilling and tapping two holes to receive set-screws for preventing the spindle from turning.



Surface Grinder Spindle with Direct Motor Drive



A Drill Press for the Machine Shop or a Mortiser and Shaper for the Pattern Shop

Delta Versatile Machine

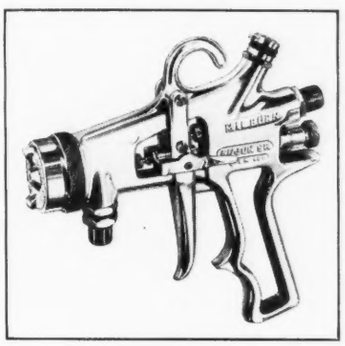
A machine that is primarily a sensitive drill, but can also be used in the pattern shop as a router, mortiser, or shaper, has been placed on the market by the Delta Mfg. Co., 3775 N. Holton St., Milwaukee, Wis. The table of this machine is adjustable vertically a distance of 43 inches. The spindle travel is 4 inches. The standard chuck has a capacity for drills up to 17/32 inch, and holes can be drilled in the center of a 14-inch circle. Spindle speeds of 590, 1275, 2450, and 5000 revolutions per minute are standard, but a speed of 8000 revolutions per minute can be supplied for operations such as routing and shaping.

Themachine is equipped with interchangeable spindles. For mortising operations, a special attachment is used. The head is reversible for shaping operations.

Milburn Paint Spray Gun

A paint spray gun of the construction illustrated has been placed on the market by the Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore, Md. This spray gun is made in two sizes—the Type M for large industrial and automotive work, and the Type N for fine touching up and "high lighting." These types weigh 1 1/4 pounds and 1/2 pound, respectively.

The body of the gun consists of a triangular aluminum-alloy



Paint Spray Gun Made by the Alexander Milburn Co.

frame designed to house and protect the working parts from injury. The fluid nozzle and air atomizer head are said to be constructed on new principles.

Electrode-Holder for Atomic-Hydrogen Arc Welding

An electrode-holder has been developed by the General Electric Co., Schenectady, N. Y., for use in atomic-hydrogen arc welding with flexible tungsten electrodes. The electrodes are carried in curved tubes which form a part of the holder and are brought into position by means of a screw-feed ejector. The electrodes can be consumed to a length of about 1 1/2 inches.

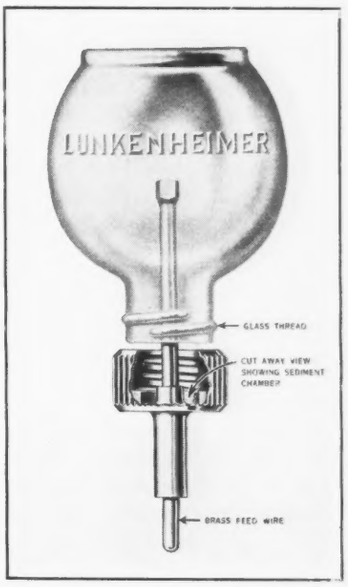
The electrodes are made up of several small-diameter tungsten wires which have been stranded together. They are so flexible that the ends of a 12-inch length can be brought together without giving a definite set.

The tubes of the electrode-holder are easily detachable, so that the user can make the necessary replacements. There is an adjustment on the holder for controlling the position of the fan-shaped welding flame—that is, for making it either parallel with or at right angles to the axis of the handle.

Metal-Spraying Equipment

A new metal-spraying gun has been brought out by the Metal Spray Co., 113 Llewellyn St., Los Angeles, Calif. Metal-spraying devices, in general, consist of an air turbine, reduction gears for transferring power to knurled wheels that feed wire to a nozzle, a mixing chamber for oxygen and acetylene, a combustion chamber or nozzle for burning the combined gases to melt the wire, and an air blast for atomizing and ejecting the molten particles.

In the gun here shown the turbine and reducing gears are enclosed in an aluminum case—the wire-feeding wheels, gas-mixing chamber, and nozzle being a separate unit. This design prevents any metal particles from reaching the gears and causing wear, gives a visible control of the wire feed, and eliminates the possibility of combustible gases collecting in the gear-case. The capacity of the device ranges from No. 12 Brown & Sharpe gage to 3/16-inch diameter wire.

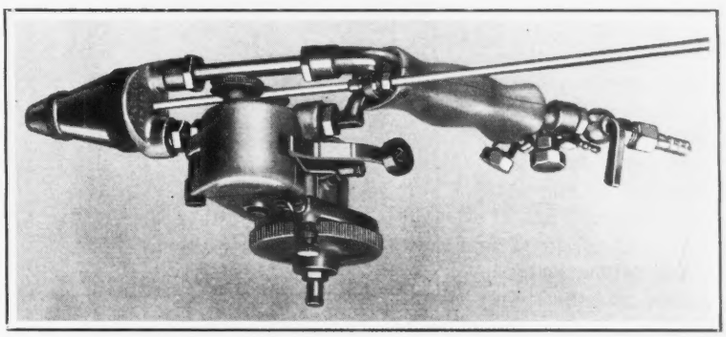


Automatic Bottle-oiler for Supplying Lubricant to Plain Bearings

Automatic Bottle-Oiler

Three major parts—a glass bottle with a threaded neck, a bronze base with an integral sleeve type of shank, and a brass feed wire, make up a new bottle-oiler brought out by the Lunkenheimer Co., Cincinnati, Ohio. A thick cork washer seals the joint between the bottle and the base.

This oiler is intended to supply the proper amount of lubricant automatically to plain bearings. It feeds only when the shaft is in motion. Oil is fed by the periodic expansion and contraction of the air within the bottle due to changes in temperature, and by capillary action, which is aided by the agitation of the feed wire when the shaft is in motion.

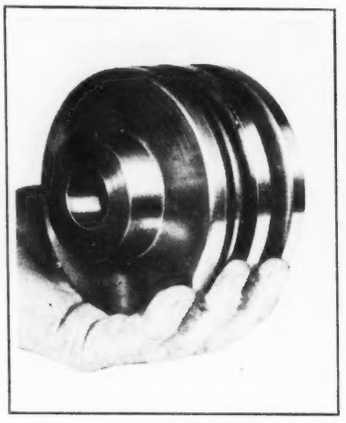


Metal-spraying Gun Made by the Metal Spray Co.

Stearns Magnetic Clutch of Small Dimensions

A magnetic clutch that is only 5 inches in diameter, but develops 500 pound-inches of pull-out torque, has been produced by the Magnetic Mfg. Co., Milwaukee, Wis., for a machine tool builder. This clutch weighs only 9 1/2 pounds. It is 3 3/4 inches long. The current consumption is approximately 100 watts.

Simple design and few parts are features of the clutch. The collector rings are located around the outside circumference and stay well within the outside diameter. This construction saves considerable space over the usual method of hub mounting. The clutch is of a true single-disk type in that there is only one wearing surface. There are no moving parts, a feature that reduces maintenance costs.



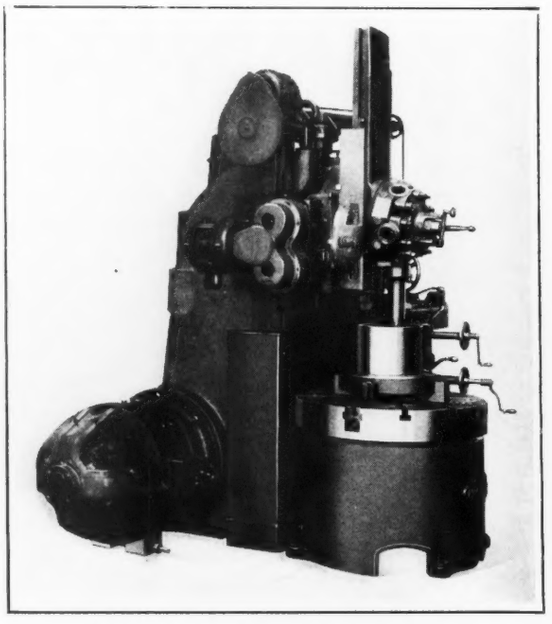
Magnetic Clutch 5 Inches in Diameter

Bullard Completely Motorized Vertical Turret Lathes

Vertical turret lathes, completely motorized to fit them primarily for high-speed work, have been brought out by the Bullard Co., Bridgeport, Conn. These machines are designed to take full advantage of the carbide cutting tools. In the case of the 42-inch machine, for example, table speeds ranging from 4.1 to 150 revolutions per minute are available.

The illustration shows the main drive motor with a flange mounting on the machine column. The method of installing the power-traverse and rail-raising motors can also be seen. In addition, there is an individual motor for the lubricating system, which provides filtered oil to the spindle bearings. The lubricating pump motor is so interconnected to the main drive control that the main drive motor would automatically be stopped if the pump motor should cease functioning.

In addition to the flange mounting for the main drive motor, this motor may be placed on the floor and be direct-coupled to the machine or it may be mounted on the floor or on a bracket at the rear of the machine for driving through a chain or V-belts.



Bullard Vertical Turret Lathe Built for High-speed Work

A Course in Welded Construction Design

A brief course in welded construction for designers is offered by the John Huntington Polytechnic Institute, Cleveland, Ohio, in cooperation with the Lincoln Electric Co. The course is of one week's duration and will be repeated several times during the coming winter season. Part of the time will be spent in the operator's training school at the Lincoln Electric Co., and in the evenings lectures on designing for arc-welded construction will be given at the John Huntington Institute.

The course is planned for designing engineers, machine designers, chief draftsmen, and structural engineers. Further information may be obtained by addressing Dean Alfred Mewett, John Huntington Polytechnic Institute, Cleveland, Ohio, or E. W. P. Smith, consulting engineer, Box 683, Cleveland, Ohio. This course should not be confused with the four weeks operator's training course which is maintained continuously by the Lincoln Electric Co.

* * *

A committee headed by Henry W. Clausen, 1062 First National Bank Bldg., Chicago, Ill., as chairman, has been formed for the revision of bankruptcy laws of the various states. Working in conjunction with more than twenty trade associations, this committee, recognizing the glaring abuses to which present bankruptcy laws are subject and the cost to American business of these abuses, aims, first, to acquaint American business with the bankruptcy situation and the necessity for improvement in the laws; and, second, to formulate suitable laws and secure their passage.

NEWS OF THE INDUSTRY

New England

BULLARD CO., Bridgeport, Conn., announces that the Langbein Works, Leipzig, Germany, recognized authorities in the field of electro-deposition and cleaning of metal surfaces, have concluded an agreement with the Bullard Co., under the terms of which the Langbein Works are to introduce the Bullard-Dunn metal descaling process in Great Britain and Continental Europe. The Bullard-Dunn electro-chemical method, which was described in October, 1930, MACHINERY, was carefully tested in the research laboratories of the Langbein Works and found to be highly satisfactory and economical in removing oxide and scale from metal surfaces.

WILLIAM GILES NEWTON has opened an office at 151 Court St., New Haven, Conn., as a consulting engineer specializing in die-castings and die-casting equipment. Mr. Newton has had many years of experience in the die-casting industry, having been successively secretary of the E. M. Gray Mfg. Co., East Orange, N. J.; president of the Marf Machine & Die Casting Co., Brooklyn, N. Y.; and president of the Newton Die Casting Corporation, New Haven, Conn.

GLENN E. WEIST, formerly sales engineer with the Milwaukee Electric Hoist Division of the Harnischfeger Co., Milwaukee, Wis., has joined the Kron Co., Bridgeport, Conn., manufacturer of automatic dial scales for all industrial uses. Mr. Weist is in charge of engineering. He is a graduate of Purdue University and a man of wide experience in the engineering field.

WHITNEY MFG. CO., Hartford, Conn., has made arrangements with the Barbour Stockwell Co., of Cambridge, Mass., to sell the complete line of Whitney silent and roller chains and sprockets in the New England territory. Roller chain will be carried in stock at Cambridge.

P. F. MCDONALD, president of the P. F. McDonald Steel Co., Boston, Mass., sailed on November 11 for a three months business trip to England, Germany, France, Belgium, and Sweden, where the mills furnishing steel to the P. F. McDonald Steel Co. are located.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that the headquarters of the manager of the plastics department have been moved from Meriden, Conn., to Pittsfield, Mass. Hot-molded products will be made at Pittsfield and cold-molded products at Meriden. The sales offices of the department are at Lynn, Mass.

OSTER MFG. CO. and WILLIAMS TOOL CORPORATION, Cleveland, Ohio, have appointed the ParKett Machinery Division of the Austin-Hastings Co., Inc., Cambridge, Mass., agent to handle the Oster and Williams lines of pipe and bolt threading equipment in the New England territory.

New Jersey and Pennsylvania

FRED C. ARCHER has been appointed manager of the Philadelphia district for Lincoln Electric Co., Cleveland, Ohio, and will be located at 401 N. Broad St., Philadelphia. Previous to joining the Lincoln staff, Mr. Archer was president of the Fred C. Archer Co. which he organized in 1925. Before going into business for himself, he was employed by the Kelly-Springfield Co. and the White Motor Co.

J. S. TRITLE, vice-president and general manager of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been elected president of the National Electrical Manufacturers' Association to succeed JOHN H. TRUMBULL, former Governor of Connecticut.

GEORGE M. SHARER has been appointed sales manager of the eastern division of the Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., with headquarters in Philadelphia. Mr. Sharer has been connected with the Link-Belt Co. in Philadelphia in various capacities for the last thirty-two years.

George M. Sharer

J. H. Wood

J. H. WOOD, formerly sales engineer for the Baldwin-Southwark Corporation of Philadelphia, Pa., has been appointed eastern sales manager of the Lake Erie Engineering Corporation, Buffalo, N. Y., manufacturer of hydraulic and power tool equipment. Mr. Wood's headquarters will be at 104 Jefferson Ave., Haddonfield, N. J. Previous to his connection with the Baldwin-Southwark Corporation, he was for a number of years works manager of the Camden Iron Works of Camden, N. J., and at one time was general superintendent of the Kilby Mfg. Co. of Cleveland, Ohio. From 1917 to 1925 Mr. Wood owned and operated the Eastern Machinery & Equipment Co. of Philadelphia.

AJAX ELECTROTHERMIC CORPORATION, Trenton, N. J., announces that the company has licensed the Westinghouse Electric & Mfg. Co. to make high-frequency or coreless induction furnaces or heaters for applications in the field of metal heating. The Ajax Electrothermic Corporation, in turn, has received a license from the Westinghouse Electric & Mfg. Co. to use certain patents of the latter company.

C. E. STEPHENS, formerly commercial vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., with headquarters in New York City, was elected vice-president. He will remain in New York. N. G. SYMONDS, formerly commercial vice-president at Chicago, was elected vice-president in charge of sales. His headquarters will be at the general offices in East Pittsburgh.

HUGH BENET has been made manager of the Harrison, N. J., Works of the Worthington Pump & Machinery Corporation. Since 1927, when Mr. Benet became associated with the Worthington organization, he has served as manager of the corporation's Holyoke, Mass., Works.

New York

DR. IRVING LANGMUIR, associate director of the General Electric Research Laboratory, Schenectady, N. Y., will receive, in Stockholm, Sweden, on December 10, the Nobel Award in Chemistry for 1932, the greatest international recognition that any scientist can receive. To Dr. Langmuir, the Nobel Award is a distinctive honor added to previous recognitions. He has received the Nichols Medal awarded by the American Chemical Society, the Hughes Medal from the Royal Society of London, the Rumford Medal from the American Academy of Arts and Sciences, the Cannizaro Prize from the Royal Academy of Lincei, Italy, in addition to many other recognitions. He is a past-president of the American Chemical Society and has been affiliated with the General Electric Research Laboratory since 1909.

AMERIKA-INTERESSEN, INC., American representative of the A. G. für Amerika-Interessen, with offices in Berlin, Paris, and London, has opened an office in the Chrysler Building, New York, for the purpose of bringing foreign patents to the attention of American manufacturers, with a view to having new products manufactured in this country. The firm is also in a position to negotiate arrangements abroad for American patents. The company now has about one hundred devices that appear suitable for manufacture in this country. These cover many fields—machine tools and appliances, electrical devices, air-conditioning equipment, welding processes, etc.

DR. WILLIS RODNEY WHITNEY, organizer and for thirty-two years director of the research laboratory of the General Electric Co., Schenectady, N. Y., has retired from that position owing to poor health. He is succeeded by DR. WILLIAM DAVID COOLIDGE, senior associate director of the laboratory. Dr. Whitney, however, continues to hold the position as vice-president in general charge of research. Dr. Coolidge, the new director, was born in Hudson, Mass., and received his training at the Massachusetts Institute of Technology and at the University of Leipzig, Germany. He was appointed assistant director of the laboratory in 1908, and associate director in 1928.

F. M. STARR of the central station engineering department of the General Electric Co., Schenectady, N. Y., has been awarded what is known as the Alfred Noble Prize, established in 1929 in memory of Alfred Noble, a prominent engineer of the Middle West, for a technical paper of particular merit presented before one of the national engineering societies. The prize, which carries with it an award of $500, will be presented to Mr. Starr at the winter convention of the American Institute of Electrical Engineers in New York City for his paper "Equivalent Circuits."

GENERAL ELECTRIC CO., Schenectady, N. Y., has brought out a new line of full voltage magnetic switches, built to the standards of the Underwriters' Laboratories for industrial control equipment, for use in locations where inflammable or volatile liquids, gases, or mixtures are stored, manufactured, or used. The switches are weatherproof and suitable for use in corrosive atmospheres.

STACEY BROS. GAS CONSTRUCTION CO., Cincinnati, Ohio, manufacturer of gas holders, gas plant equipment, and special fabricated plate work, announces the removal of its New York office to 24 State St., New York City. Wm. S. Guitteau is eastern manager, and will cover the New England states and the Atlantic Seaboard as far west as Pittsburgh.

DARDELET THREADLOCK CORPORATION, 120 Broadway, New York City, has licensed the Baldwin Locomotive Works, Philadelphia, Pa., to manufacture for their own use bolts, nuts, and other parts threaded with the Dardelet self-locking thread.

ROOT-CONNERSVILLE-WILBRAHAM, Connersville, Ind., manufacturers of blowers, exhausters, pumps, and meters, announce that the New York office of the company has been moved to 24 State St. D. L. Dowling heads the staff in New York, and N. C. Barnard and A. E. Loyd are associated with him.

CHARLES W. NASH, chairman of the board of the Nash Motors Co., has been appointed chairman of the Taxation Committee of the National Automobile Chamber of Commerce.

Ohio and Michigan

A. L. FREEDLANDER, vice-president and factory manager of the Dayton Rubber Mfg. Co., Dayton, Ohio, recently has been investigating the possibilities for further development of rubber plantations in South America. From South America he went to Europe by the famous airship *Graf Zeppelin*. In Europe, Mr. Freedlander will confer with leading automotive engineers concerning recent developments in the manufacture of Dayton Cog-Belt drives and other products of the company.

A. L. Freedlander

EX-CELL-O AIRCRAFT & TOOL CORPORATION, 1200 Oakman Blvd., Detroit, Mich., has appointed the Central Tool Sales Co., 602 W. Randolph St., Chicago, Ill. (formerly known as the Paddock-Graven Co.), representative in the Chicago territory for all the products manufactured by the Continental Tool Division of the company and all Ex-Cell-O products except the precision boring machine line. William H. Scheer, formerly with the Ex-Cell-O organization in this territory, has become a member of the new sales organization. The company has also appointed the Dean Machinery Co., 80 E. Jackson Blvd., Chicago, Ill., representative handling the Ex-Cell-O line of precision boring machines and the Krueger-Wayne Tool Division products, which include multiple drilling equipment, jigs, fixtures, and sheet-metal dies.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., has appointed E. J. von der Heide sales representative to handle Farrel-Sykes gears, gear units, and gear generators in the Middle West territory. Mr. von der Heide's headquarters are at 824 Miami Savings Building, Dayton, Ohio.

JEFFREY MFG. CO., Columbus, Ohio, manufacturer of electric locomotives, chains, and conveying and crushing machinery, has removed its southwestern branch office from Houston to Dallas, Tex. T. P. Burke will continue as manager.

THE NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION announces that the address of the Association's office is now 1220 Guarantee Title Bldg., Cleveland, Ohio. Formerly, the offices were located at 1415 Enquirer Bldg., Cincinnati, Ohio.

Pacific Coast

DUNNING PROCESS CO., INC., 932 N. La Brea Ave., Hollywood, Calif., announces that the company is prepared to make industrial motion pictures in color and with sound for both 35- and 16-millimeter portable movie projectors. The company also arranges for the distribution of films nationally in fifteen cities. Elliott A. Allen, industrial engineer, formerly with the U. S. Steel Corporation, the S K F Industries, Inc., the Timken Roller Bearing Co., and the General Motors Corporation, is in charge of the sales promotional and distribution work of the company.

Washington, D. C.

R. Y. Ferner Co., 1127 Investment Bldg., Washington, D. C., American representative of the Société Genevoise d'Instruments de Physique, of Geneva, Switzerland, has appointed the following agents to handle portable hardness testing instruments: A. Preston Petre, 608 Stewart Bldg., Baltimore, Md.; Galvin Machinery Sales Co., Brisbane Bldg., Buffalo, N. Y.; Pacific Machinery & Tool Steel Co., Portland, Ore.; A. M. Andrews, 2215 Leslie Ave., Detroit, Mich.; and La Chapelle, 389 St. Paul St., W., Montreal, Canada.

Wisconsin

Falk Corporation, Milwaukee, Wis., manufacturer of speed reducers and other power transmission equipment, has appointed G. J. Sturmfelsz representative in the Baltimore district, with offices at 1620 E. 32nd St. H. Douglas Stier has been appointed representative in the Atlanta territory, with offices at 101 Marietta St.

New Books and Publications

The Design, Fabrication, and Use of Milling Cutters, Twist Drills, and Broaches—Milling and Drilling Processes—Modern Large-Scale Forging. Compiled by Professor A. P. Gwiazdowski. 64 pages, 6 by 9 inches. Published by Machine Shop Engineering, 1503 Shadford Road, Ann Arbor, Mich. Price, 75 cents. Two copies, $1.

This is the first volume of a series of small books dealing with machine shop processes intended for foremen, draftsmen, toolmakers, diemakers, and machinists. The first volume contains six lectures on tool engineering delivered as part of a course in this subject at the College of Engineering, University of Michigan. The subjects of the lectures are: The Engineer in Modern Production; Milling Cutters, Their Design and Manufacture; the Design, Fabrication, Heat-treatment, and Uses of Twist Drills; Milling and Drilling with Particular Reference to the Performance of Drills and Milling Cutters; the Development and Application of Internal and Surface Broaching; and Tool Engineering in Modern Large-scale Forging.

These lectures are followed by an explanation of the technical terms used in the lectures, and information on the care and use of twist drills, the testing of metals, and hardness testing. Each of the lectures was prepared by men well qualified, through their experience and achievements, to prepare authoritative information on the subjects dealt with.

Common Sense Applied to Motion and Time Study. By Allan H. Mogensen. 228 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $2.50.

The material in this book is based on a booklet prepared by the author for use in connection with a course in time and motion study at the Massachusetts Institute of Technology, together with a number of articles on motion study that appeared in *Factory and Industrial Management*. This material has been thoroughly revised and brought up to date. It is divided into sixteen chapters dealing with the following subjects: Motion and Time Study—What Is It?; Value of the Open Mind; The Process Chart; Time Study and Rate Setting; Motion Study Applied to the Manufacture of Small Parts; We're Not Experts in Micromotion Technique, but We're Learning Fast; Disciples of Motion Economy; Micromotion Study; Operation Analysis with the Motion-picture Camera; Motion Study in the Job Shop; Motion-study Principles and Their Application in a Department Store; Motion Study Applied to Group Work; Use of the Camera in Training; See What Motion Study Did to Plant Lay-out; Relation of Motion Study to Machine Design, Tool Design, and Safety; and Taking and Using the Motion Picture.

Time and Motion Study, and Formulas for Wage Incentives. By Stewart M. Lowry, Harold B. Maynard, and G. J. Stegemerten. 471 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $5.

This is the second edition of a book dealing with time and motion study and methods of establishing a compensation that is mutually satisfactory to employer and employe. The book is designed to fulfill the dual purpose of a textbook for technical schools and a handbook for practical men and factory executives. The text is divided into three parts: Part I takes up step by step the method of making a time study; Part II deals with the methods of constructing formulas from time-study data; and Part III explains how to organize and supervise time-study, formula, and wage-payment work in any plant. In the second edition of this book, the authors have given more attention to the subject of motion study than in the first edition. A complete description of the methods to be followed in making an analytical motion study has been added, together with a brief description of motion-picture technique for making motion studies.

Vibration Prevention in Engineering. By Arthur L. Kimball. 145 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $2.50.

This book is the outcome of a series of lectures presented at the Harvard Engineering School. The author, who is associated with the research laboratory of the General Electric Co., has been engaged in research work on the prevention of noise and vibration, and the problems that have arisen have indicated the need for a convenient reference work on this subject. The purpose of the book, therefore, is to present, in concise form, a resumé of the various aspects of vibration prevention in engineering which have come directly within the author's experience. The book is intended to serve as a reference work for practicing engineers and also for students in the advanced course in engineering of the General Electric Co.

Prevention of Automobile Accidents. By Victor W. Pagé. 172 pages, 4¼ by 6½ inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, paper-bound, 50 cents; cloth-bound, 75 cents.

In view of the growing number of accidents caused each year by the operation of automobiles, this little book should be of considerable interest and value. The author is a recognized authority in the field, having written several works on automotive subjects. He tells in clear, simple language the important points to observe in order to avoid accidents, and gives many practical suggestions on the safe operation of automobiles, as well as instructions for inspection and adjustment of the car mechanism to prevent loss of control.

An Attachment for Turning Approximately Spherical Surfaces of Small Curvature on a Lathe. By I. C. Gardner. 11 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper No. 467 of the Bureau of Standards. Price, 5 cents.

Review of World Production (1925-1931). 166 pages, 8 by 10½ inches. Published by the League of Nations, Geneva, Switzerland. Available in the United States through the American agent, the World Peace Foundation, 40 Mount Vernon St., Boston, Mass. Price, $1.25.

Plain and Thread Plug and Ring Gage Blanks. 47 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Commercial Standard CS8-30 of the Bureau of Standards. Price, 15 cents.

Man-Hour Electrical Estimating Manual. By Theodore Heinzerling, consulting electrical engineer. 384 pages, 8 by 11 inches. Published by Rurick Press, Inc., 303 W. 42nd St., New York City. Price, $10.

Coming Events

DECEMBER 5-9—Annual meeting of the American Society of Mechanical Engineers in the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary.

DECEMBER 5-10—Tenth National Exposition of Power and Mechanical Engineering at the Grand Central Palace, New York City.

DECEMBER 8-9—Eighth annual conference on welding to be held at Purdue University, Lafayette, Ind., under the auspices of the Engineering Extension Department.

JANUARY 7-14—National Automobile Show at the Grand Central Palace, New York.

JANUARY 23-26—Annual meeting of the Society of Automotive Engineers at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary, 29 W. 39th St., New York City.

JANUARY 28 - FEBRUARY 4—National Automobile Show at Chicago, Ill.

MARCH 8—Regional meeting of the American Society for Testing Materials in New York City. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

JUNE 19-23—Annual convention and exposition of the American Foundrymen's Association at the Hotel Stevens, Chicago, Ill. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

JUNE 26-29—Semi-annual meeting of the American Society of Mechanical Engineers at the Hotel Stevens, Chicago, Ill. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Obituaries

TINIUS OLSEN

Tinius Olsen, founder and until December, 1929, president of the Tinius Olsen Testing Machine Co., Philadelphia, Pa., who died on October 20, was a pioneer in the development of testing machinery in the United States. He was a native of Kongsberg, Norway, and came to the United States sixty-five years ago. He was eighty-six years old at the time of his death, and was the oldest life member of the Franklin Institute, which honored him by presenting him with both the John Scott and the Elliot Cresson Medals.

He was also honored by his native country in a most unusual manner for his achievements in the engineering field, his philanthropy to the city of his birth, and his assistance to engineering progress in Norway. On September 16, 1928, a statue of him was unveiled at his birthplace in Norway in recognition of his services. The cost of the statue was met by popular subscription in his native country, from which he also received many other honors. The King of Norway made him a Knight of the Order of St. Olaf.

Mr. Olsen's son, Thorsten Y. Olsen, succeeded him as president of the Tinius Olsen Testing Machine Co. in 1929, and continues as the head of the firm.

WILLIAM LAIDLAW

Major William Laidlaw, president and manager of William Laidlaw, Inc., Belmont, N. Y., manufacturer of metal-cutting band saws and special machinery, died October 24 at his home in Belmont, N. Y. Major Laidlaw was born in Sheffield, England, in 1880. In 1905, after his arrival in the United States, he became foreman of the Clark Tool Works, Inc., in Belmont, N. Y. Later, he moved to Whitewater, Wis.; but after the war he returned to Belmont, and in 1925, purchased the Clark Tool Works, incorporating under the name of William Laidlaw, Inc. He manufactured successfully many of his own inventions in the metal-cutting field, including a metal-cutting band saw. Major Laidlaw was an officer in the Illinois National Guard for sixteen years, and served in the American Expeditionary Force and in the Army of Occupation throughout the war. He is survived by his widow, Carolyn Knox Laidlaw, treasurer of the company, and one daughter.

GERALD E. BROWNELL, superintendent of the Grinding Machine Division of the Norton Co., Worcester, Mass., died suddenly on October 30 at the age of fifty-eight. Mr. Brownell had been connected with the Norton Co. for thirty-one years, starting as supervisor of installation of grinding machines. Later he became general foreman, and in 1918 was appointed assistant superintendent. Two years later, he was advanced to the position he held at the time of his death.

GEORGE BAILY, assistant sales manager of the merchandising department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., died of cerebral hemorrhage on October 29 while attending a football game in Pittsburgh. He had been associated with the Westinghouse organization for many years.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

of MACHINERY, published monthly at New York, N. Y., for October 1, 1932.

State of New York)
County of New York) ss.

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None; Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; and Erik Oberg, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press, 140-148 Lafayette St., New York; Estate of Alexander Luchars, 140-148 Lafayette St., New York; Louis Pelletier, 140-148 Lafayette St., New York; Erik Oberg, 140-148 Lafayette St., New York; Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; Laura A. Brownell, 140-148 Lafayette St., New York; Franklin D. Jones, 140-148 Lafayette St., New York; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; and Helen L. Ketchum, Atlantic Ave., Cohasset, Mass.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 21st day of September, 1932

CHARLES P. ABEL,
Notary Public, Kings County No. 210
(SEAL) Kings Register No. 3011
New York County No. 15, New York Register No. 3-A-6
(My commission expires March 30, 1933)

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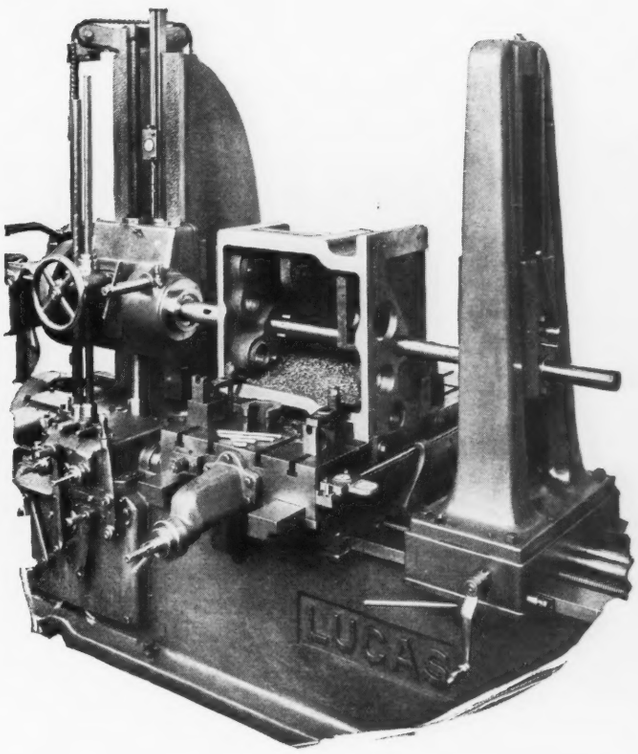

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Classified Contents of this Number

Automobile Shop Practice

Long Life of Tungsten-carbide Tools in Machining Automobile Parts 247
Weighing and Marking Automobile Pistons—*By A. W. Dilts* 279

Design, Fixture and Tool

Broach-holder that Opens and Closes Automatically 255
Pot Chuck with Combined Centralizing and Clamping Feature—*By D. L. Brown* 256
Universal Jig for Drilling Collars—*By Charles Kugler* 257

Design, Machine

The Note-book Habit Develops Mechanical and Engineering Ability—*By William R. Howell*.... 246
Gearless Variable-speed Transmission—*By R. T. Todd* 251
Stop Mechanism for a Power Press Equipped with a Magazine Feed—*By Edward Lay* 252
Future Developments in Machine Tool Design—*By Guy Hubbard* 259
An Intricate Drive Problem Ingeniously Solved... 271
Converting Inches to Millimeters 280

Diemaking, Die Design, and Press Work

Developing a Punch for Curling Eyelets—*By H. R. Schmidt* 254
Simple Die for Flanging Tubing—*By Walter Simpson* 255
Progressive Die for Hinges—*By Charles D. Olson* 258
Arithmetical Formulas for Determining Chord Heights of Two Adjoining Punches—*By Emil Wittmann* 273
Using a Power Press to Operate a Bench Press—*By S. A. McDonald* 285

Grinding Practice

Abrasives and Grinding Wheels Have Kept Pace with Modern Trends 261
Parallels for Use on Magnetic Chucks—*By Walter V. Sovitzky* 272

Inspection and Gaging Methods

Gage for Checking Inaccessible Tapered Holes—*By H. Kaffine* 257
A Combination Fillet and Length Gage—*By H. R. Hageman* 272

Management Problems

Extravagance of Using Old Equipment 248
Even the Elimination of Waste Should Have Facts as Its Basis 250
Credit Arrangements Between Germany and the Soviet Republic 258
Ten Years' Progress in Management 282
Turning Time for Shafts of Various Diameters and Lengths—*By C. F. Scribner* 284

Materials, Metals, and Alloys

Micarta Bearings for Rolling Mills 248
Machine Tool Handwheels and Knobs Made from Synthetic Plastic Materials 263
Materials Used for Cutting Tools in Present-day Shop Practice—*By J. V. Emmons* 276
A Demonstration of J-Metal Tools 281

Meetings and Expositions

Meeting of the Acetylene Association 278
Annual Meeting of the Mechanical Engineers 282
Exposition of Mechanical Engineering 288

Shop Practice, General

New Automatic Air-control Valve 252
Field of Application of Broaching Machines Broadens 264
Improved Methods and Alloys Aid Die-Casting Industry to Expand 266
Progress in Forging Practice 270
Repairing Damaged Center Holes in Lathe Spindles—*By William C. Betz* 272
Cutting Teeth on Tiny Burrs and Formed Milling Cutters—*By F. H. Mayoh* 274
Smallest Ball Bearing Manufactured 275
Shaper Effectively Used in Machining Die-blocks.. 283
Localized Hardening Process 286
Shop Equipment News 289

Unemployment and Rehabilitation Problems

A Study of the Causes Will Help to Prevent Future Depressions 250
Robertson Recommends Broader Study of Economics 280
Rehabilitation Work in Connecticut 281
A Workable Plan for Putting Men Back to Work.. 288

Welding Practice

Arc Welding Introduces New Methods in Machine Design—*By Everett Chapman* 241
Welding Offers a Convenient Means of Rehabilitation 250
Fillet Sizes for Arc-welded Construction—*By E. W. P. Smith* 283

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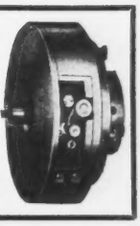

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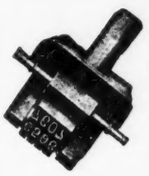

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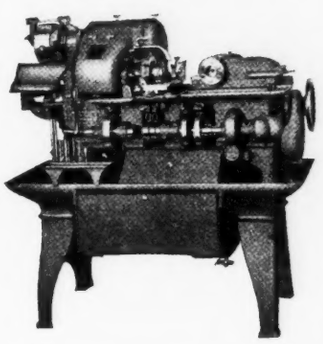

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No. 3 Cincinnati H.P. Vert. SPD.
No. 3 Rockford Rigidmil; 98% new.
No. 4-B Milwaukee Plain; double overarm; motor-in-base; 98% new.
No. 4 Cinti. H.P. Plain S.P.D.
18" Cincinnati Auto. Miller, M.D.
24" Cincinnati Auto. Miller, M.D.
No. 30 Sundstrand Rigidmil; Hydr. Feeds; new.
No. 33 Kempsmith Auto. Miller.

GRINDERS
No. 4-A Landis Crankshaft Grinder.
No. 13 B & S Tool Room Gdr.; comp. eqpt.
10"x52" Landis Self Contained.
6"x18" Landis Self Contained.
Walker Single Stroke Surface Grinder.

MISCELLANEOUS
Wickes Punch & Shear, 48" throat, 1¼" thru 1¼.
1½" Landis Bolt Cutter, Grd. Hd. M.D.
2" Landis Bolt Cutter, lead screw attachment.
No. 4 Warner & Swasey, Universal Turret Lathe.
25 Ton Henry & Wright Dieing Machine.
50 Ton Henry & Wright Dieing Machine.
No. 76 Toledo Open Back Gap Frame Press.
No. 2-A Warner & Swasey Univ. Turret Lathes.
If the machines you need are not listed above, send us your inquiry. We have a very large stock.

Cincinnati Machinery & Supply Co.
29 West Second St., Cincinnati, Ohio

REBUILT MACHINE TOOLS

GRINDERS
No. 60, 65, 70, 75 Heald Internal.
No. 3 Rivett Internal Grinder.
Capital Ball Bearing Internal Grinder.
Garvin Hole Grinder.
No. 1 Morse Plain Cylindrical Grinder.
No. 11 Brown & Sharpe Pl. Self-Con. Cyl. Gdr.
6x32", 12x72" Norton Plain Cylindrical.
6x18", 10x24", 10x30", 10x36", 10x52", 12x36", 16x52" Landis Plain Self-Contained Cylindrical Grinders, belt drive.
16x48", 16x68" Landis Crankshaft Grinders.
No. 6G Diamond Disc Grinder.
No. 8, 12, 14, 120 Gardner Disc Grinders.
No. 51 Besly Motor Driven Disc Grinder.
No. 1½, 2 Cincinnati Univ. Tool & Cutter Gdrs.
No. 1, 2, 3, 4, 13 Brown & Sharpe Univ. Gdrs.

LATHES
No. 37 Cataract Bench Lathe, belt drive.
12"x5' Hendey Yoke Head.
14"x6' American, cone head.
14"x6' Lodge & Shipley, cone head.
16"x6' Greaves-Klausman, cone head.
16"x6' Hendey Geared Head.
16"x8' Lodge & Shipley Selective Head.
16"x12' American cone head.
16"x12' American Geared Head.
17"x8' Sidney cone head.
18"x8' American Geared Head.
18"x8' Greaves-Klusman cone head.
18"x8' Hendey Yoke Head.
20"x8' American Geared Head.
20"x8' Hendey Geared Head.
20"x10' LeBlond cone head.
24"x10' Greaves-Klusman cone head.
24"x12' American Geared Head.
24"x16' Lodge & Shipley cone head.
27"x16' American Geared Head.
30"x20' American Geared Head.
36"x20' American Geared Head.
36"x20' Bridgeford Geared Head.
36"x28' American Geared Head.
36"x40' American Geared Head.

MILLING MACHINES
No. 3 Cincinnati Universal,. S.P.
No. 3 Ohio Universal, cone pulley.
No. 1½ A, 3A Owen Universal, cone pulley.
No. 1½ Brown & Sharpe Universal, C.P.
No. 2, 3, 4 Cincinnati Vertical, S.P.
No. 3 Toledo Vertical, S.P.
No. 5 Cincinnati Plain, rect. overarm.
No. 2, 3, 4 Cincinnati Plain, S.P.

DRILLS
21, 24" Cincinnati Bickford Upright.
21, 25" Weigel Upright
24" Barnes All Geared.
D2, D3, D4 Colburn H.D.
3½, 4, 5, 6' Amer. Triple Purp. Radials.
4, 5, 6' Cincinnati Bickford Plain Radials.
6 spindle No. ½ Avey.
2 spindle No. 1 Avey.
No. 00S, 18S Garvin Horizontal Duplex.
No. 216, 220 Baker H.D. 2 spindles.

MISCELLANEOUS
16, 20, 24, 28" Gould & Eberhardt Shapers.
24" American Shaper, single pulley.
No. 2, 3 J. N. LaPointe Broaches.
No. 3, 3½, 4, 5 Greenerd Arbor Press.
15, 30, 50 ton Lucas Power Forcing Presses.
No. 4½ Marquette T.C. Press.
No. 206B Toledo D.C. Press.
No. 20, 21 Bliss O.B.I. Presses.
Chain Hoists, ½ to 5 tons.
1", 1½", 2" Landis Bolt Cutters, sgl. & dbl.
No. 5 Mitts & Merrill Keyseater.
No. 2, 4, 6, 8 Warner & Swasey Turret Lathes.
No. 2A, 3A, 4 Warner-Swasey Univ. Tur. Lathes.

Write for our new Stock List No. 33 listing 1500 machines in stock

THE EASTERN MACHINERY CO.
3267 Spring Grove Ave., Cincinnati, O.

GUARANTEED—REBUILT
Metal-Working Machinery
Largest stock, every description
SIMMONS MACHINE TOOL CORP.
Albany Jersey City New York

ENGINE LATHES
12"x6', 14"x8', 18"x8' Hendey.
14"x6', 17"x6', 17"x10' Leblond.
16"x8' Springfield geared head.
16"x8', 20"x8' Lodge & Shipley.
18"x8' Cisco geared head.

1200 TOOLS IN STOCK
MILES MACHINERY CO.
Saginaw, W. S., Mich.

WHAT ARE WE GOING TO DO ABOUT DEPRESSIONS?

That there are serious defects in the industrial and business system under which we are operating, has recently been demonstrated with startling and tragic emphasis. It has also been made increasingly and painfully evident to every one of us that in this breakdown in the functioning of our industrial mechanism, it isn't only industry as a whole and the big corporations that suffer. The individual is hit and hit hard. And so it is every man's business to take stock of the situation—to ask himself what is wrong and what can be done about it.

Much has been said and written on this subject. Hundreds of theories have been advanced. The confusion grows deeper every day. Few who are not trained economists can comprehend all the intricacies of this involved problem and there is good reason to believe that even the economists are none too sure. But suppose instead of attempting to comprehend all the complicated and puzzling details of the economic picture, we concentrate attention on one or two features of outstanding importance. Instead of looking for a remedy which will cure all our troubles, suppose we tackle one at a time, locating the root of the trouble and setting to work to develop a practical remedy. In that way steady progress can be made, slow perhaps but vastly better than no progress at all.

The fact that there are many things concerning the human body which have not yet been explained and are only vaguely understood, has not deterred medical science from making remarkable strides in preventive and curative medicine and our economic ills are, after all, similar in many ways to our bodily ills. They both take time and patience to cure. It is no more reasonable to expect that all of our business ailments can be stamped out at once than to suppose that all sickness and disease can be immediately eliminated from the world, but the great progress which has admittedly been made to alleviate human suffering points the way to business and industry in its present plight.

What are we going to do about it? Our practice has been like that of a man who periodically walks around a circular course blindfolded. Part of the going is smooth but part of it is filled with obstacles and pitfalls. That is the part we are negotiating now and our economic body is suffering from severe bruises and cuts. First-aid measures have been taken by our Government to bind up our wounds and help us to recover, but if we are going to find any *permanent* cure for our troubles we must remove the blindfold and undertake to repair the road.

One of the deepest pitfalls is our inability to maintain a balance of production with consumption. Year after year we go at this job blindfolded and every so often get badly hurt at it. We can remove the blindfold by demanding and getting sufficient business statistics so that a manufacturing executive may in the future know exactly what the level of production and consumption is, both of industry as a whole and of his own special division of it. With such information available it would be a comparatively simple matter to keep production operations in approximate balance with consumption and avoid making the disastrous mistakes of previous years. Some of course would continue to make these mistakes regardless, but it does not seem likely that a large percentage would persist in such folly and the major defect of over-production would therefore be substantially remedied.

Here then is a practical and comparatively simple remedy which can be developed. It is no illusionary panacea; neither is it an experiment, noble or otherwise. It is plain, solid common sense. While depression conditions are the result of numerous contributing forces, excess production is commonly recognized as one of the most powerful of these and the one which, more than any other, accelerates the downward movement once the swing has begun. Consequently anything we can do to reduce substantially the potency of this evil is a definite step in the right direction. We are attacking at its root one of the prime movers among the forces that generate depressions. If at the same time our defences were strengthened by widespread development of unemployment reserves in industry, our ability to resist the destructive action of depression forces would be powerfully increased.

This issue concerns the individual welfare of business men the country over. It is up to every one of us to make it our personal issue, to do something that will help develop concerted action. If we wait for the Government to initiate the move, we may find ourselves forced into a mold little to our liking, fashioned to meet political rather than business needs.

It gets down to this. Have we the energy and good sense to demand action which will benefit each of us individually as well as industry as a whole or are we going to slip back supinely into the old rut? The time has come for us to push forward and lift the operating level of industry and business on to new high ground by applying to our national economic problems the same brains and driving power which have been responsible for the remarkable progress of individual industries.

Machinery